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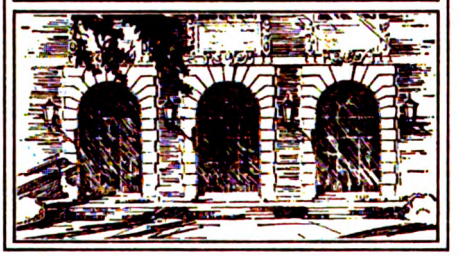

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THE

NAVAL ANNUAL,

1886.

BY

LORD BRASSEY, K.C.B.

"Pray God we may have peace with honour."—
LORD NELSON TO EARL ST. VINCENT.

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PREFACE.

In introducing the first number of the 'Naval Annual' to the public, the compiler desires to acknowledge his obligations to many fellow-labourers who have assisted in the preparation of a volume dealing with a wide range of difficult technical questions.

It is intended that the 'Naval Annual' shall appear yearly, and it is hoped that it may be the means of bringing together a large amount of information on naval subjects, which has hitherto been obtainable only by consulting numerous publications and chiefly from foreign sources.

In the preparation of future editions the compiler earnestly invites the co-operation of naval and professional men. Accuracy and completeness can only be attained by their assistance.

July, 1886.

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SECTION I.

RECENT NAVAL ADMINISTRATION.

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RECENT NAVAL ADMINISTRATION.

CHAPTER I.

General Policy.

The present being the first number of the 'Naval Annual,' it is proposed to give a general view of the administration of the Navy since the publication of the compiler's former volumes on the British Navy.

Impartiality of view.

In dealing with naval affairs political partizanship should be forgotten. The struggles between parties should be viewed in the spirit of impartiality in which they were regarded by Lord Nelson. "I am," he wrote, "of no party. I hope and believe that any Administration would ever act to the best of their judgment. I am not one of those who think that the safety of the country depends on any one or one hundred men: let them go off the stage and others could ably supply their places. . . .

"Politicians are not like other men, and probably all men would be politicians if they had the sense."

Lord Northbrook's administration.

It became the fashion to abuse the Board to which the compiler happened to belong, and he may perhaps be permitted to believe that its members deserved a more generous measure of acknowledgment than they received. From the commencement of their administration they steadily increased the building of ironclads. They undertook and pushed forward vigorously the re-armament of the fleet with heavy breech-loading guns. They greatly improved the types of the unarmoured ships. These are services for which they have received scanty recognition. Their successors, both Conservative and Liberal, have been more fortunate. Their administration has been able, and they have received from the public a well-merited tribute of praise. They will themselves be the first to recognise the great advantages they have enjoyed in inheriting from their predecessors those increased

Tribute to the late Conservative Board.

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estimates without which the recent rapid development of the Navy would have been impossible.

At this stage it is unnecessary to enter upon the questions raised before the Committee on Admiralty accounts, which sat at the close of the session of 1885. This matter is fully treated in a speech of the compiler, which will be found in a later chapter of the present work.

Tendency to a disparaging view of Navy.

But, while not endeavouring here to discuss the merits of this particular controversy, some observations published in the *Engineer*, in its issue of the 7th August, 1885, may be appropriately quoted:—

"Criticism has always been busy and has never been fully satisfied. In a pamphlet published some few years ago, and supposed to have been written by the Duke of Somerset, there was a shrewd remark that 'the mind of man does not go back to the time when the management of the Navy by the Admiralty was not a subject of dissatisfaction.' The comment has lost none of its force since the date when it was written, and into whatever period we look we find Englishmen lamenting that their Navy is in a condition to invite disaster and defeat."

Historical research will supply abundant illustrations of the justice of these observations. We find Lord Nelson writing from the Victory on the 8th July, 1804—

"The French Navy is daily increasing, both at Toulon and Brest, whilst ours is as clearly going down hill."

In a former communication addressed to Lord Keith, the same illustrious commander said:—

"You will see by the report of the disposition of the ships what a wretched state we are in. In truth only the Foudroyant and Northumberland are fit to keep the sea."

Later illustrations of similar pessimist opinions were quoted by the *Engineer*.

In 1874 Mr. Ward Hunt made a statement as to the strength of the fleet, which provoked Sir John Hay to say it was discreditable that the late Board should have allowed such a state of things to arise. He declared it was the business of the naval officers at the Board to have resigned rather than to have countenanced a policy resulting in so much mischief. Bad as things were, Mr. Ward Hunt proposed to do so little that Sir Edward Reed regarded the estimates as a practical abandonment of the position of this country in Europe.

Lord Northbrook's administration shared, though perhaps in more than ordinary degree, the unpopularity to which, after an extended term of service, every Admiralty seems to be doomed.

At this stage it may not be superfluous to remark that each

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successive administration is bound, at least at the outset, to a large extent by the policy of their predecessors. What was the state of the Navy as it was handed over to Lord Northbrook's Board by our predecessors? What was the standard of expenditure which they had accepted? What were the distinctive features of their administration? They had devoted great attention to the repairs of the fleet. They had been called upon to prepare for warlike operations in the East. The construction of ironclads had been retarded by the controversy raised by Sir Edward Reed, as to the design for the Inflexible, but four ironclads had been purchased out of money provided under a vote of credit. During the Russo-Turkish war the Naval expenditure had been largely increased, and at the conclusion of peace a policy of retrenchment was naturally desired by the country. The reduction of the estimates in the years immediately preceding Lord Northbrook's term of office was a natural consequence of the pacification of eastern Europe. It may be claimed for the Board, of which the present writer was a member, that its policy must in fairness be viewed in connection with that of the previous Board.

Administration of Mr. W. H. Smith.

Dealing first with the manning of the Navy, the policy of the Board which he so ably represented was explained by Mr. Trevelyan, in the House of Commons, in 1881. "We have decided," he said, "to refrain from these expensive variations in our enlistments, which in past years had operated both financially and administratively so much to the disadvantage of the Navy. It was laid down by our immediate predecessors at the Admiralty that between 18,000 and 19,000 was the normal number of blue-jackets at which we ought to aim. These figures have been accepted by ourselves without question. The entry of boys has been carefully regulated with a view to maintain a proper force of seamen."

Statement by Mr. Trevelyan in 1881.

For some years past the officers, the seamen of the fleet, the coast-guard and marines, had been maintained at an approximately identical standard of strength. In order to provide for manning the new ships which will shortly be completed an addition of 2,000 men and boys to the Naval service has lately been sanctioned.

State of the Navy *personnel*.

From the *personnel* we pass to the *materiel* of the fleet. By far the greater part of our expenditure is automatic. It represents the pay, the victualling, the pensions of officers and men, and the charge for the maintenance of our large establishments at home and abroad. It is chiefly in the building votes that the distinctive policy of a Government is shown. Viewed in the light of these observations, the following tables afford a clear indication of the policy pursued by successive administrations.

Tabular statement. Shipbuilding votes.

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Expenditure on Shipbuilding, 1875–76 to 1885–86.

Year.	Ascertained Expenditure on Shipbuilding and New Machinery.		Number of Men employed on Shipbuilding in Dockyards at Home.		Ascertained Expenditure on Repairs at Home and Abroad.	Number of Men employed on Repairs in Dockyards at Home and Abroad.	Total Number of Men employed in Dockyards at Home.	Expenditure on Naval Ordnance (Army and Navy Estimates)	Total Expenditure under Votes 6 and 10.	Total Expenditure on Shipbuilding and Ordnance.
	Armoured.	Unarmoured.	Armoured.	Unarmoured.						
	£	£			£			£	£	£
1875–76	1,058,463	554,755	3,592	1,997	953,677	5,265	15,780	246,189	3,540,092	3,772,601
1876–77	940,318	1,181,642	3,142	3,007	807,656	4,776	15,807	416,865	3,929,846	4,301,711
1877–78	1,948,472†	973,970†	2,308	3,345	1,069,425	5,113	16,074	369,348	5,123,591	5,458,839
1878–79	631,195	876,854	3,228	2,764	1,064,151	5,471	17,177	507,000	3,810,737	4,269,737
1879–80	631,724	756,883	3,545	2,688	822,220	4,566	16,381	397,000 *211,745*‡	3,106,563	3,460,563
1880–81	698,798	727,551	4,362	2,206	841,710	4,708	16,894	377,968 *248,975*	3,082,803	3,425,803
1881–82	949,313	733,187	5,306	2,557	691,080	4,465	17,192	458,686 *290,749*	3,318,555	3,736,669
1882–83	990,710	776,304	5,718	2,675	881,810	5,486	18,924	740,691 *534,695*	3,472,953	4,156,644
1883–84	1,260,137	669,953	5,922	2,742	929,236	5,888	19,610	792,023 *509,429*	3,615,264	4,245,382
*1884–85	1,284,700	699,550	5,193	3,200	958,680	5,803	18,849	794,497 *512,549*	3,998,320	4,607,237
*1885–86	1,590,000	1,431,440	5,012	3,277	875,862	5,308	18,702	1,399,232 *856,908*	5,047,320	6,102,652

* Estimated only.

† These amounts include the cost of armoured and unarmoured tonnage purchased out of Vote of Credit.

‡ The figures in *italics* do not include cost of ammunition and small arms.

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For 1886–7 the Navy Estimates provide for the following expenditure for ships building or completing:— Estimates 1886-7.

	£
Armoured ships	2,394,835
Protected	194,576
Partially protected	4,052
Unprotected	620,438
Torpedo boats	341,468
Sundry services	108,658
	3,664,027
Expenditure for other services not included in the above	164,700
Grand total expenditure for 1886–7 on all ships building and completing for sea	£3,828,727
Total expenditure under Votes 6 and 10	£5,457,617
Total number of men employed in Dockyards at home	19,873
	£
Guns (for Ships building).—Expenditure borne by War Department, not included in the grand total given above	435,596
Gun mountings, torpedo carriages, &c., included in the grand total given above	344,780
	£780,376*

In the programme of shipbuilding in the dockyards for 1885–6 the armoured and unarmoured tonnage was approximately the same as for the previous financial year. The protected tonnage was increased by 600 tons. In the shipbuilding by contract the tonnage showed a large increase from 4624 to 11,338 tons. The dockyard and contract programme combined gave a total of 14,423 tons for armoured vessels, 6087 tons for protected, and 7542 for unarmoured vessels, or a total of 28,052 tons. Comparison with former years.

Comparing the programme for 1885–6 with those of former years, the total armoured tonnage was increased from an average of 8051 tons per annum in 1877–81, and 11,948 in 1881–5, to 14,423 tons. The protected tonnage was 6087 tons, or together 20,500 tons. In unarmoured vessels the average construction for the six preceding years had been somewhat less than that proposed in the programme for 1885–6. Increase in armoured building 1877–86.

The policy of Lord Northbrook in relation to armoured construction was persistently pursued from the commencement to the close of his administration. It was the duty of the present writer to speak in public from time to time as one of the representatives of the Board, and while claiming for the Navy that superiority of strength which had been secured by the combined efforts of successive Administrations, he urged the necessity for further efforts with a frankness not common Compiler's speech at Bristol, 1881.

* This sum does not include the expenditure for re-armament of ships, &c. The total sum voted in Army and Navy Estimates for Naval Ordnance is £1,752,900.

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in official statements. In a speech delivered at the Colston Hall, at Bristol, in November, 1881, it was said:—"In the present position of affairs the action of the British Naval Administration must depend mainly on the policy pursued by the French Government. In ships actually ready for sea our ironclad fleet compares favourably with the French, but this will cease to be the case if armoured shipbuilding in France is continued with the activity displayed since the close of the Franco-German War. Since 1877, the total armoured tonnage launched has been 29,171 tons for the French, and 21,704 tons for the British Navy. Our Navy Estimates provide £750,000 for armoured construction. The sum provided for the same service in the French Estimates is no less than £1,081,000. It is obvious that this disparity cannot long continue. From an English point of view it seems impossible to justify the lavish expenditure of the French; and I would venture to hope that the friendly representations of our Foreign Office would not be without effect in relieving us from the necessity of imposing additional burdens on the British taxpayers."

Mr. Trevelyan, House of Commons, 1882.

For the early years of the late Liberal Administration no more authoritative statement of their shipbuilding policy can be quoted than that supplied by the following observations taken from the speech delivered by Mr. Trevelyan in the debate raised by Lord Henry Lennox in April, 1882. Mr. Trevelyan, on that occasion, spoke as follows:—

"When Lord Northbrook became First Lord of the Admiralty, it became their business to examine the state of their own and foreign Navies; and the conclusion at which they arrived was, that the time had come when they ought to increase the rate of iron shipbuilding; and so, without making any noise about it, they began building the ships which the right hon. gentleman opposite had commenced, at a faster rate. In 1880–1, instead of 7,231 tons, Lord Northbrook actually built 9,235, and in 1881–2, 10,816 tons; and this latter estimate was adhered to within 100, or, he might say, 40 tons. . . . That was the quiet and unsensational, and not ineffectual way, in which they had dealt with the situation."—(3 *Hansard*, [268] 1057.)

Lord Northbrook, House of Lords, 1883.

A general statement of the policy of the Board in relation to armoured shipbuilding is contained in the following extracts from speeches delivered by the Earl of Northbrook in the House of Lords. On the 12th April, 1883, replying to Viscount Sidmouth, he spoke as follows:—

"I do not wish in the least to say anything offensive to our neighbours across the Channel. They have in their discussions, and in the reports of their Committees, especially in the report of a Com-

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mittee presided over by no less a man than M. Gambetta, frankly admitted that England stood unrivalled in regard to her Navy. I hold that no Government of this country—and certainly it is not the intention of the present Government—would for a moment allow any nation to take a position of equality with England at sea. Such a policy would be discountenanced on whatever side or party. There can be no doubt, as the noble viscount pointed out, that for the last six or seven years great activity has prevailed in France in the construction of ships. But this activity is due to a policy, which has been openly declared, and the reason of which I would desire to state, because it has been stated in authentic documents which have been laid before the French Chamber. During the Franco-German war—as your lordships may well understand—the French Government were unable to devote the average attention and expenditure to their Navy, added to which they have taken a different course to ourselves in respect to the construction of their ironclad ships. Almost all the French ironclads up to a recent date have been built of wood, whereas we have adopted iron and steel from a very early date in our construction. Those of your lordships who have a knowledge of the subject are aware that wooden ships do not bear the same length of existence as iron and steel vessels, and, therefore, it was the opinion of a Commission of the French Chamber in the year 1878 that in a certain number of years a considerable number of wooden armour-plated ships in France would become unserviceable, and that it would be necessary to replace them with new ships. The programme laid down in accordance with that has been gradually carried out by the French Government. No one who has considered the question will think for a moment that the gradual fulfilment of such a programme should for a moment give rise to any susceptibility on our part.

"In comparing the two navies, any officer or gentleman who wishes to make it as bad as possible for us, omits a lot of ships from a list of our Navy, and adds a lot of ships to the French or other navy which are perfectly useless. I can assure the noble viscount I have carefully considered the question, and I do not believe in his apprehensions. I am bound to say that I think it is desirable to increase very materially the amount of construction, but I may explain to your lordships that five years ago new dimensions were adopted, and it was discovered that greater power was produced in a gun by means of the use of slower-burning powder, which very much revolutionized the construction of ships by making it necessary to place very much thicker armour upon the ships. Then, again,

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there had been important improvements in engines and other technical matters with which I need not trouble your lordships; all of which changes have delayed construction. And I have no doubt they had a very material effect upon the policy of the Board of Admiralty which we succeeded in the matter of construction. Taking into consideration all these questions, the present Board of Admiralty have found that they can increase the amount of armour-plated tonnage constructed, not at an extravagant rate, but at a rate more in accordance with the rate laid down in former years."

Lord Northbrook, House of Lords, 1884.

In the Session of 1884 Lord Northbrook was again called upon from his place in the House of Lords to defend the policy of the Admiralty. On that occasion, he said:—

"We decided, gradually but substantially, to increase the provision made for the construction of armour-plated ships. In 1880, although, as I have before remarked, we found the Navy Estimates already introduced, we were able to make an arrangement by which the progress of the armour-clad ships on the stocks was accelerated; and in the years 1881, 1882, and 1883 we very largely increased the provision for the construction of such ships. Probably, the best way of showing this is to compare the expenditure on the hulls and machinery of such ships year by year. In 1879–80 it was £631,724; in 1880–81 it was £698,798; in 1881–82 it was £949,313; in 1882–83 it was £990,710; in 1883–84 it was 1,260,137; and in 1884–85 £1,232,900; or, in round numbers, the sum appropriated to armour-plated construction has been doubled. I will now give the names of the ships laid down during the last four years. In 1880, in England, the Collingwood was laid down; in France none. In 1881 we laid down the Impérieuse and Warspite; France the Hoche. In 1882 we laid down four—the Howe, Rodney, Camperdown, and Benbow; France two, the Neptune and Marceau. In 1883 we laid down the Anson, and France the Magenta. In the four years we have laid down eight ships, and France four."

Subsequently to the date of the speech from which this extract is borrowed, Lord Northbrook's Board laid down the Hero, Sans Pareil, and Renown. In France two ironclads have been laid down, but the work of construction has been suspended.

Times, Portsmouth correspondent, 1885.

The principles enunciated by Lord Northbrook in his successive speeches as First Lord of the Admiralty were approved by the most competent critics of naval administration. In an article published on the 17th July, 1885, the able correspondent of the *Times* at Portsmouth expressed himself as follows: "This policy was not a

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matter of haphazard, but was founded upon certain definite principles which in course of years, and when the urgent necessity for an irresistible navy had become less pressing, might have given the country an efficient fleet of armour-clads. The first principle was not to ask the House of Commons for a large vote to secure an immediate increase in armour-plated tonnage, but to prefer the course which his lordship considered the wiser one, of making the necessary increase 'gradually and steadily, and not at one time by a very large expenditure of public money.' Another principle followed was to avoid the example of other Powers in laying down monster fighting ships, and to confine the armour-clads built to the moderate displacement of 10,000 tons, and costing not very far from three-quarters of a million each. A third principle was to take sufficient money to press forward as quickly as possible the ships under construction; a fourth was to avoid the multiplication of types; while the fifth and last enumerated was to attach special importance to the element of speed. It is not necessary to describe the satisfactory results to which the observance of these vital principles conduced."

General results of naval administration. *Engineer.*

If we look back on the administration of the Navy under the ablest statesmen who have preceded Lord Northbrook, we find that they were confronted with the same difficulties, and that they met them, as Lord Northbrook met them, in the spirit of caution and compromise. Referring to the administration of Mr. Goschen, the following observations from the *Engineer* may be appropriately quoted: "In 1873 Mr. Goschen was bewildered with the multitude of counsellors. There were advocates for masted turret ships, for turret ships without masts, and for broadside ironclads. Some proposed the entire abandonment of armour; others the use of armour to protect the vitals of the ship; some considered the guns to be everything, while others had peculiar faith in the defensive element, concerning which again there was a dispute as to whether a ship should have a continuous belt or should dispense with it at the extremities. About the same time Sir Spencer Robinson declared, in regard to the splendid display which had taken place at Spithead, that nothing was so remarkable 'as the absence of what ought to have been there.' Still, the Admiralty have managed to make progress, and if sometimes the progress has seemed rather slow, it has been possible to find a reason for it. Mr. Goschen, in his day, considered England so strong in the matter of ironclads, that although we could not altogether suspend shipbuilding, we could yet afford to proceed with judgment and calmness; and, above all, we could 'avoid

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the fatal mistake of deciding too soon.' This has been the usual style, except at periods of panic, when there has been a grand rush, and a sort of golden avalanche has come down upon the Admiralty. As for the risk of 'deciding too soon,' certainly there have been some odd decisions in the past, though at the time when they were arrived at they may have seemed very prudent and proper."

Views of the Compiler.

Viewing the policy of the Board of Admiralty, of which the compiler was a member, in the light of experience, it cannot with justice be said that undue hesitation was shown in the development of the shipbuilding operations of the Navy. From the first the expenditure and the construction had been steadily, and indeed very considerably, increased until the year 1884–5. The mistake consisted in yielding to financial considerations which, owing to the falling revenue, were doubtless of a pressing nature, and keeping the estimates for 1884–5 at the same figure as in the preceding year.

The deficiency in the construction of torpedo boats, and the necessity for doing more in the defence of coaling stations, and in providing graving-dock accommodation abroad, especially in India, were prominent topics in a speech delivered by the present writer at Portsmouth on the 12th August, 1884. That speech was answered by Lord Henry Lennox, and public attention was shortly afterwards awakened by a series of able articles in the *Pall Mall Gazette* on the condition of the Navy. It was not contended that the Government had spent money badly, but that they had not spent enough. The increased risks at stake were insisted upon, as evidenced by the statistics of the growth of our imports, our exports and our shipping. The views taken by the writers of those articles were unduly disparaging to the British Navy. Our superiority in ironclads was not sufficiently acknowledged. It was pushing the argument unfairly to compare the war fleet despatched by the French to the China seas with the numerical strength of our ordinary peace squadron on that station. The value of the reserve of cruisers in the mercantile marine was not taken into the account of our means of defending our commerce, but when every allowance has been made for the exaggeration of our deficiencies, the fact remains that the demands were fully justified for increased estimates. It had become urgently necessary to strengthen the Navy in fast cruisers, and in the torpedo flotilla. The long delay in the adoption of breech-loading guns could only be compensated by increased activity in construction. The coaling stations abroad were not in a proper state of defence.

Pall Mall Gazette.

Quarterly Review, 1869.

It is not a condemnation of the Board of Admiralty to acknowledge their obligations to the Press. In an article on "Politics as a

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Profession" in the *Quarterly Review* of January, 1869, it was truly said:—"It is impossible for anyone conversant with the motive agencies of the time not to recognise the extent to which the Press now performs—some might say usurps—many of the functions of Parliament and the Executive Government. The Administration may not be so much to blame for this seeming abnegation of its functions as at first appears, for it is busy, feeble, and hampered."

Under a Liberal constitution, such as that so happily established in this country, the people are more powerful than their rulers. The force which governs is not the bureaucracy, but public opinion.

The demands originally formulated in the columns of the *Pall Mall Gazette* were unanimously supported in the Press and by public opinion. The permanent strength of the Navy must ever depend on the will of the nation; and no movement such as that which has lately taken place could proceed from the action of a particular party or the influence of an individual Minister. "It is," said Lord Beaconsfield, "quite a wild idea that a body of men, though they may be Ministers, can meet in a room and suddenly alter the establishments of a country. The establishments of a country are adapted to the policy which the country pursues." Lord Beaconsfield.

Under Lord Northbrook's Administration the building votes were increased from £3,082,000 in 1880–81 to £5,047,000 in 1885–86. The truth is that at the bidding of the nation, we entered upon a new policy.

The national anxiety, as expressed in the columns of the public journals, had been awakened by the ambitious policy of our most powerful naval rival. The remarkable growth of the French Navy is due to a comparatively recent effort. This is clearly explained in an article contributed by Sir Nathaniel Barnaby to the last edition of the *Encyclopædia Britannica*. In the period 1873–77 France expended in building and completing armoured ships for sea not more than half the sum which was spent in the corresponding period for our own Navy. Since 1877, the French expenditure on building had always equalled, and generally exceeded that of England. Increase of Navy of France.

This statement is confirmed by figures taken from the tables published in the work of M. Gougeard.

Expenditure on armoured Shipbuilding—Hulls only.

		£
1874–78 4 years	England	3,978,712
	France	1,852,000
1878–85 7 years	England	5,247,342
	France	5,990,375

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A comparison between the shipbuilding votes (including repairs) in France and England, pointing to the same conclusion, is given in the next Table, taken from the Navy Estimates presented to Parliament in the two countries :—

Date.	England. (Votes 6, 10.)	Date.	France. (Votes 11, 12, 15, 16, 17, 18, 19, 20, and Budget Extraordinaire.)
	£		£
1875-76	3,636,538	1875	2,050,000
1876-77	3,983,605	1876	2,038,880
1877-78	5,179,601	1877	2,391,910
1878-79	3,861,317	1878	2,398,758
1879-80	3,162,622	1879	2,840,860
1880-81	3,147,585	1880	2,898,112
1881-82	3,376,484	1881	3,120,899
1882-83	3,516,216	1882	3,254,569
1883-84	3,830,633	1883	3,383,346
1884-85	3,810,105	1884	3,175,357

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CHAPTER II.

Comparative Strength of the Maritime Powers.

The expenditure on building and armaments having been reviewed in detail, the adequacy of the efforts put forth may be gauged by comparing our available strength with the fleets of other nations.

Committee on Budget de la Marine, 1886. State of the French Navy Ironclads.

The following description of the French Navy is taken from the Reports of the Select Committee of the Chamber of Deputies on the Estimates for 1886:—"We possess at this moment, exclusive of ships in construction, ten effective sea-going ironclad battle-ships. Four, the Amiral Duperré, the Dévastation, the Colbert, and the Suffren, are in Commission. Another ship is complete for sea, five are under repair. Of these ironclads, seven, the Colbert, the Friedland, the Marengo, the Océan, the Richelieu, the Suffren, and the Trident, are of old type. All, except the Friedland, are wood built, and without water-tight compartments. Our Fleet of completed ironclads includes, in addition, five cruisers and four coast-defence ships. The armoured cruisers are deficient in speed. The coast-defence vessels are less open to criticism. The ironclad fleet in construction comprises thirteen ships, with a speed somewhat superior to that of the majority of the completed battle-ships, two armoured cruisers, two coast-defence ships, and eight armoured gunboats. The latter are intended for coast defence, but would be much less effective than torpedo boats. If the use of the torpedo did not tend in a great measure to neutralise the armoured strength of maritime powers, we should regard our ironclad fleet as absolutely insufficient."

Unarmoured ships.

The condition of the unarmoured fleet is thus described by the Committee: "It is not true to say that we have not a single cruiser, but the truth, and it is painful enough, is that we have four, the Duquesne, the Tourville, the Milan, and the Hirondelle. Two of these are of the first, one of the second, and one of the third class. A fifth vessel, the Sfax, is approaching completion. Of our fast cruisers built and building, the Sfax and the three others of the same type alone combine the conditions of unsinkability required in a

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ship of war. The insufficiency of our fleet in fast cruisers is obvious. It should be remedied as soon as possible.

Small vessels.

"We do not think it necessary to refer in detail to the inferior types largely represented in our Navy list. They are a '*sorte de poussière Navale*' constructed to meet the requirements of our extended Colonial empire. Though useful for the maintenance of order in our Indo-Chinese and other territories, they add nothing to the strength of our Navy. It might even be said that they tend to weaken it by absorbing a part of its resources. We want some '*modus vivendi*,' some plan for defraying the cost of maintaining order and security in our great possessions out of local revenues, reserving exclusively for the Fleet the appropriations derived from the Navy Estimates."

Torpedo flotilla.

The Committee reported that in the French Navy they had a total strength of 64 torpedo boats complete, of which 12 were of the first and 43 of the second class, with 4 torpedo vedette boats. They had in construction 8 torpedo sloops, 9 sea-going torpedo boats, and 4 torpedo cruisers. They recommended that at least 100 additional torpedo boats should be provided for the defence of the Naval Ports, and an equal number for the general defence of the coasts of France.

Comparative tables, ironclads: England and France.

Having quoted the latest official opinion on the strength of the French Navy, the following Tables will supply the most important data upon which an independent judgment may be formed. As a broad principle, displacement is the fairest measure of the relative fighting powers of contemporary ships. Displacement represents so much weight, whether of armament, machinery, fuel or materials used in the construction of the hull. The following tables give a summary of the present and prospective conditions of the armoured fleets of France and England:—

Armoured Ships.

1885.

England.			France.		
Class.	Ships.	Displacement.	Class.	Ships.	Displacement.
		Tons.			Tons.
1st . .	13	121,920	1st . .	3	30,400
2nd . .	14	85,940	2nd . .	12	87,200
3rd . .	14	112,410	3rd . .	13	61,931
Coast Defence .	14	41,530	Coast Defence .	12	34,352
Total . .	55	361,800	Total . .	40	213,883

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Armoured Ships—*continued.*

1890.

England.			France.		
Class.	Ships.	Displacement.	Class.	Ships.	Displacement.
		Tons.			Tons.
1st . .	22	210,560	1st . .	10	105,314
2nd . .	24	141,920	2nd . .	18	126,740
3rd . .	12	98,380	3rd . .	4	19,887
Coast Defence .	14	41,530	Coast Defence .	19	42,212
Total . .	72	492,390	Total . .	51	294,153

The ships included in the First and Second Classes are enumerated in the Tables subjoined.

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Comparative Statement of the Armoured Battle-Ships of France and England, 31st March, 1890.

SHIPS COMPLETED.

TABLE I.—First Class.

Hulls of Iron. Maximum armour not less than 9 inches. Displacement exceeding 8,500 tons.

England.						France.					
Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.	Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.
	Tons.	Knots.	Ins.				Tons.	Knots.	Ins.		
Devastation	9,330	13·84	14	4 35-ton M.L.	1871	Amiral Duperré	11,100	14·22	21½	4 48-ton	1879
Dreadnought	10,820	14·20	14	4 38 „	1875	Dévastation	10,100	15·17	15	4 48 „	1879
Inflexible	11,880	13·80	24	4 80 „	1876	Redoutable	9,200	14·66	14	8 27 „	1876
					Purchased in	Courbet	9,700	15	15	4 49 „	1882
Neptune	9,310	14·20	13	4 38 „	1878	Amiral Baudin	11,380	15	21½	3 75 „	1883
Thunderer	9,330	13·40	14	2 38 „	1872	Formidable	11,441	15	21½	3 75 „	1885
Alexandra	9,490	15	12	2 25 „	1875	Neptune	10,581	15	18	2 50 „	
Hercules	8,680	14	9	8 18 „	1868	Hoche	10,650	15	18	2 50 „	
Sultan	9,200	14·13	9	8 18 „	1870	Marçeau	10,581	15	18	2 50 „	
Téméraire	8,540	14·50	11	4 25 „	1876	Magenta	10,581	15	18	2 50 „	
					Purchased in						
Superb	9,170	13·80	12	16 18 „	1878						
Ajax	8,510	13·25	18	4 38 „	1880						
Agamemnon	8,510	13·25	18	4 38 „	1879						
Edinburgh	9,150	15·50	18	4 43-ton B.L.	1882						
Colossus	9,150	15·50	18	4 43 „	1882						
Collingwood	9,150	16·40	18	4 43 „	1882						
Howe	9,700	17	18	4 67 „	1885						
Rodney	9,700	17	18	4 68 „	1884						
Benbow	10,000	17	18	2 110 „	1885						
Camperdown	10,000	17	18	4 67 „	1885						
Anson	10,000	17	18	4 67 „	1886						
Sans Pareil	10,470	16.75	18	2 110 „							
Renown	10,470	16·75	18	2 110 „							
Total . 22	210,560					Total . 10	105,314				

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TABLE II.—Second Class.

Hulls of Iron (I.) or of Wood (W.). Maximum Armour not less than 8 inches. Displacement not exceeding 8,500 tons.

England.							France.						
Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.		Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.					Tons.	Knots.	Ins.			
Monarch	8,320	14·94	10	4 25-ton M.L.	1868	I.	Colbert	8,457	14·47	8½	8 23-ton	1875	W.
Audacious	6,010	12·83	8	10 12 „	1869	I.	Trident	8,800	14·17	8½	8 23 „	1876	W.
Belleisle	4,870	12 20	12	4 25 „	1876	I.	Richelieu	9,100	13·11	8½	6 23 „	1873	W.
Invincible	6,010	14·09	8	10 12 „	1869	I.	Friedland	8,540	13·30	8	8 23 „	1873	I.
Iron Duke	6,010	13·64	8	10 12 „	1870	I.	Marengo	7,187	13·49	8	6 23 „	1869	W.
Nelson	7,630	14·41	9	4 18 „	1876	I.	Suffren	7,600	14·30	8	4 23 „	1870	W.
Northampton	7,630	13 20	9	4 18 „	1876	I.	Océan	7,500	13·70	8	4 23 „	1868	W.
Swiftsure	6,910	13·75	8	10 12 „	1870	I.	Bayard	5,881	14·53	10	4 15½ „	1880	W.
Triumph	6,640	12	8	10 12 „	1870	I.	Turenne	6,400	14·14	10	4 15½ „	1879	W.
Orion	4,870	13	12	4 25 „	1879	I.	Fulminant	5,574	13·22	13	2 28 „	1877	I.
Shannon	5,390	12·35	9	2 18 „	1875	I.	Tonnerre	5,574	14·01	13	2 28 „	1875	I.
Hotspur	4,010	12·65	11	2 25 „	1870	I.	Vauban	5,900	14·32	10	4 18½ „	1882	I.
Imperieuse	7,390	17	10	4 18-ton B.L.	1883	I.	Terrible	7,200	14·50	19½	2 75 „	1881	I.
Warspite	7,390	17	10	4 18 „	1884	I.	Furieux	5,560	14	20	2 47 „	1883	I.
Conqueror	6,200	15·50	12	2 43 „	1881	I.	Indomptable	7,168	14·50	20	2 75 „	1883	I.
Rupert	5,440	13·59	14	2 18-ton M.L.	1872	I.	Duguesclin	5,869	14	9⅞	4 18½ „	1883	I.
Hero	6,200	15·5	12	2 43-ton B.L.	1885	I.	Caiman	7,230	14·50	19½	2 75 „	1885	I.
Aurora	5,000	18	10	2 22 „		I.	Requin	7,200	14	19½	2 75 „	1885	I.
Australia	5,000	18	10	2 22 „		I.							
Galatea	5,000	18	10	2 22 „		I.							
Immortalité	5,000	18	10	2 22 „		I.							
Narcissus	5,000	18	10	2 22 „		I.							
Orlando	5,000	18	10	2 22 „		I.							
Undaunted	5,000	18	10	2 22 „		I.							
Total 24	141,920						Total 18	126,740					

Note.—Three French Ships slightly exceed the limit of 8,500 tons. They practically belong to the class included in this division.

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In both navies the ships of the third class are of obsolete types, but all the English ships are iron-built and solidly constructed. The British coast-defence list includes five small turret vessels permanently stationed in Colonial waters. At home we have the Glatton, and four ships of the Gorgon class, well adapted for the defence of our commercial harbours.

The French coast-defence list comprises three vessels of greater power than any British ships in the same class:—

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.	Hull.
	Tons.	Knots.	Ins.			
Tonnant . .	4,707	11	13	2 47-ton	1880	I.
Tempête . .	4,523	12·80	13	2 28 „	1876	I.
Vengeur . .	4,523	10·83	13	2 48 „	1878	I.

The French list includes, in addition, eight armoured gunboats, four of 1,030 tons, and four of 1,610 tons.

The fast unarmoured ships of France and England, built and building, are shown in the following Tables:—

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Unarmoured Vessels (Built and Building).

ENGLAND.

Knots 16 to 17.				Knots 17 to 18.				Knots 18 and over.			
Name.	Speed.	Tons.	Total Tons.	Name.	Speed.	Tons.	Total Tons.	Name.	Speed.	Tons.	Total Tons.
Inconstant . .	16	..	5,780	Polyphemus . .	17	..	2,640	Iris . . .	18	3,730	3,730
Shah . . .	16	..	6,250	Alacrity . . }	17	1,400	2,800	Mercury . .	18	3,730	3,730
				Surprise . . }				Merseys—4 . .	18	3,550	14,200
				Leanders—4 . .	17	3,750	15,000	Grasshoppers—4 .	19	450	1,800
				Archers—8 . .	17	1,630	13,040				
				Scouts—2 . .	17	1,430	2,860				
Total—2.	..	..	12,030	Total—17 .	..	..	36,340	Total—10. .	..	..	23,460

FRANCE.

Knots 16 to 17.			Knots 17 to 18.				Knots 18 and over.		
Name.	Speed.	Tons.	Name.	Speed.	Tons.	Total Tons.	Name.	Speed.	Total Tons.
Duquesne . . .	16	5,800	Condor—4 . . .	17	1,280	5,120	Bombe—8 (tons 320) .	18	2,560
Tourville . . .	16	5,600					Milan	18	1,540
Sfax	16	4,488					Tage	19	7,045
							Amiral Cecille . .	19	5,766
Total—3 . .	..	15,888	Total—4 . .	..	..	5,120	Total—11 . .	..	16,911

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Vessels for police of the seas.

Of vessels adapted specially for the duty of the police of the seas, and with speeds ranging from 15 to 13 knots, we have thirty-four, of 81,000 tons, as against twenty-two French ships, of 48,000 tons.

Italian Navy.

The Italian Navy is being constructed on an ambitious scale, but the work is progressing slowly, and the execution of the plans laid down is still indefinitely remote. The list of modern ironclads built and building in Italy includes:—

Name.	Tons.	Date of Launch.
Duilio	10,570	Completed 1876.
Dandolo	10,434	„ 1878.
Italia	13,851	„ 1880.
Lepanto	13,851	Completing 1882.
Francesco Morosini	11,000	„ 1884.
Ruggiero di Lauria	11,000	„ 1885.
Andrea Doria	11,000	„ 1885.
Re Umberto	13,251	On stocks.
Sicilia	13,251	„
Sardinia	13,251	„

Of modern ironclads of the first class, two only are in an efficient condition for the sea service. It has been reported by a correspondent of the *Broad Arrow*, that of the older ships, the Principe Amadeo and the Palestro (launched in 1871) will remain serviceable only until 1890; the Ancona, Castelfidardo, San Martino, and Maria Pia (launched 1863), may last a year longer, if extensive repairs are made; the ram Affondatore (1865) may, if she receives a new boiler, last until 1893; and the Formidabile and Terribile, built in France, and launched in 1861, may serve until 1892. The unarmoured fleet of Italy includes several vessels of exceptional speed. The Giovanni Bausan and three sister ships, 3,068 to 3,700 tons, steam 17 knots; the Agostin Barbarigo and Marcantonio Colonna, 656 tons, steam 16 knots; the four corvettes of the Christoforo Colombo type, steam 15 knots.

Russian Navy.

If we look to other Powers we find that, with the exception of Italy and France, little attention has been given for several years to the construction of ironclads. In Russia the coast-defence vessels and cruisers had absorbed practically the entire resources of the Naval Department. The ironclad fleet includes only one first-rate actually completed, the Peter the Great, 9,340 tons. Powerful ironclads have been lately laid down, specially designed for service in the Baltic and the Black Sea.

The modern ironclad fleet of Russia comprises the following ships, built and building:—

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Name.	Tons.	State of Advancement.
Dimitri Donskoi	5,893	Launched 1883.
Vladimir Monomach	5,796	„ 1882.
Alexander II.	8,637	„ 1886.
Admiral Nachimoff	7,781	Launched 1885.
Alexander Nevsky	7,572	Building.
Emperor Nikolas	8,450	„
N.	9,800	„
BLACK SEA FLEET.		
Katherine II.	10,150	Launched 1885.
Sinope	10,150	Building.
Tchesmé	10,150	Launched 1886.

The aggregate tonnage of the unarmoured ships of Russia, capable of steaming over 13 knots, is 15,940 tons, and they have only two unarmoured ships building, with a speed of 15 knots.

German Navy.

A history of the development of the German Navy has been recently given in an article published in the *Revue Maritime*. In 1867 a complete building programme was laid down. It comprised

16 Ironclads.
20 Corvettes.
22 Gunboats.
8 Sloops.

The execution of this programme was pushed on with activity until the commencement of the Franco-German War. The cost of the vessels proposed was estimated at 37,000,000 thalers = £5,395,833. In a revised estimate, made in 1872, an increased appropriation of 26,000,000 thalers = £3,791,666, was asked for to meet the inevitable growth of expense, from the development of armaments and armour.

In 1882 a further revision of the shipbuilding programme was made. The aggregate strength of the German Navy was fixed at

8 Armoured Frigates.
6 Armoured Corvettes.
7 Monitors.
2 Floating Batteries.
20 Corvettes.
6 Sloops.
18 Gunboats.
28 Torpedo Vessels.
5 School ships.

The actual condition of the German Navy can be seen at a glance

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by an inspection of the Tables attached to the present volume. The list of ironclads actually completed includes seven armoured frigates, the most modern of which was launched in 1874. The later armoured vessels, five in number, are of the Sachsen type, and are designed essentially for coast and harbour defence. The unarmoured vessels include the Leipsic and Prinz Adelbert, 3,925 tons, and 16 knots; six frigates of the Bismarck type, 2,856 tons, and 13 knots; four corvettes of the Carola type, 2,169 tons, and 14 to 15 knots; and twenty-eight other vessels. Three powerful frigates are in construction. The torpedo flotilla includes the Blitz and Pfeil, 1,382 tons, speed 15 knots, and the Zieten, 975 tons, speed 16 knots. The torpedo gun-vessels Brummer and Brenner, are in construction. Their displacement is 852 tons, and speed 15 knots. Fifty-eight torpedo boats are completed, thirty-two are approaching completion, and fifteen new vessels are proposed.

Torpedo boats.

The following list of the torpedo boats of the principal powers is taken from a paper on 'Naval Tactics,' read at the Royal United Service Institution, February 1886, by Rear-Admiral Fremantle:—

Number of TORPEDO BOATS built and building up to January 1886.

	1st Class.	2nd Class.	3rd Class.	Total.
Great Britain . . .	61	19	50	130
France	57	41	9	107
Germany	59	5	3	67
Russia.	26	92	20	138
Italy	47	5	18	70
Turkey	4	..	1	5
Austria	30	7	1	38

The classification of the torpedo boats here adopted is as follows:—

1st Class.—Over 100 feet in length.
2nd Class.—Over 70 feet, and under 100 feet.
3rd Class.—Under 70 feet.

In Germany money has been granted for 105 boats to be eventually increased to 150. Four of the Russian boats are 152 feet long, and nine of the Italian boats are 148 feet.

This chapter may be appropriately concluded with the following Table, showing in a concise form the comparative strength of the principal European nations in battle-ships.

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BATTLE SHIPS OF EUROPEAN NATIONS in 1885; ships built or building (coast-defence ships omitted). The first class consists of ships of over 8,500 tons displacement, and the second class of 8,500 tons, or under. Maximum thickness of armour in both classes not less than 7 inches.*

Nation.	No. of Ships.	Displacement.	Total.		Grand Total.	
			Number.	Displacement.	Number.	Displacement.
		Tons.		Tons.		Tons.
ENGLAND.						
Built	1st Class 13	122,920	27	208,860	44	343,480
	2nd „ 14	85,940				
Building	1st „ 9	88,640	17†	134,620		
	2nd „ 8	45,980				
FRANCE.						
Built	1st Class 3	30,400	15	116,912	32	238,432
	2nd „ 12	86,512				
Building	1st „ 7	74,853	17	121,520		
	2nd „ 10‡	46,667				
ITALY.						
Built	1st Class 2	21,004	4	33,237	9	93,939
	2nd „ 2	12,233				
Building	1st „ 5§	60,702	5	60,702		
GERMANY.						
Built	1st Class 1	9,567	9	68,047	10	73,247
	2nd „ 8	58,480				
Building	2nd „ 1	5,200	1	5,200		
RUSSIA.						
Built	1st Class 1	8,749	4	21,213	9	68,081
	2nd „ 3	12,464				
Building	1st „ 4‖	39,087	5	46,868		
	2nd „ 1	7,781				
AUSTRIA.						
Built	2nd Class 6	31,040	6	31,040	7	37,940
Building	2nd „ 1	6,900	1	6,900		
TURKEY.						
Built	1st Class 1	9,120	4	19,419	5	26,119
	2nd „ 3	10,299				
Building	2nd „ 1	6,700	1	6,700		

* This limitation excludes the older and more or less obsolete ironclads.

† Two ironclads of the first class and two of the second have since been laid down; aggregate tonnage, 33,880.

‡ Including four armoured gunboats of 1610 tons displacement each, with armour 8 in. in thickness.

§ Three additional ironclads of the first class have since been laid down; aggregate tonnage, 39,753.

‖ Two additional ironclads of the first class and one of the second have since been laid down; aggregate tonnage, 25,822.

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CHAPTER III.

COMPARATIVE VIEW OF THE NAVY ESTIMATES FOR ENGLAND AND FRANCE, 1886–7.

HAVING discussed the growth of the estimates, we may pass on to consider whether with the recent additions we are making adequate provision for the Navy. Do the most recent estimates enable us to add as largely to our Fleet as we should? and do they give the means of keeping the Navy in an efficient condition?

The subjoined Table, compiled at the Ministry of Marine in Paris from the published estimates, gives the comparative expenditure on building, as distinguished from maintenance and repairs, in France and England, for twenty-five years.

Expenditure on the construction of ships and machinery for the French Navy.

Years.	Dockyard.		Contract.		Total.	Years.	English Expenditure—Stores, Labour, and Machinery. Contract and Dockyard.
	Hulls.	Machinery.	Hulls.	Machinery.			
	£	£	£	£	£		£
1864	507,586	134,067	162,656	115,887	920,196	1863–64	1,282,710
1865	635,880	136,140	20,192	81,088	873,300	1864–65	1,674,574
1866	551,748	154,926	72,858	151,816	931,348	1865–66	1,116,198
1867	575,185	105,061	45,877	149,345	875,468	1866–67	1,014,406
1868	564,409	59,516	79,890	93,289	797,104	1867–68	1,800,749
1869	506,434	65,376	53,450	43,520	668,780	1868–69	1,694,362
1870	343,614	158,180	127,989	25,233	655,016	1869–70	1,387,047
1871	292,205	89,862	13,266	16,615	411,948	1870–71	1,330,814
1872	302,638	105,998	7,120	14,076	429,832	1871–72	1,184,172
1873	415,024	101,156	65,611	32,669	614,460	1872–73	809,807
1874	561,758	157,323	24,204	46,399	789,684	1873–74	1,290,028
1875	615,409	161,670	57,776	86,525	921,380	1874–75	1,528,161
1876	709,037	124,073	133,011	88,439	1,054,560	1875–76	1,613,218
1877	788,533	121,478	242,214	149,763	1,301,988	1876–77	2,121,960
1878	843,506	128,944	319,341	210,093	1,501,884	1877–78	2,922,442
1879	765,092	110,196	412,607	216,761	1,504,656	1878–79	1,508,049
1880	792,583	112,849	237,382	232,482	1,375,296	1879–80	1,388,607
1881	722,344	104,014	320,796	197,930	1,345,084	1880–81	1,426,349
1882	774,966	109,358	341,401	174,427	1,400,152	1881–82	1,682,500
1883	851,876	127,455	374,668	205,645	1,559,644	1882–83	1,767,014
1884				Estimated	1,536,508	*1883–84	1,928,847
1885					1,510,704	*1884–85	1,900,000
	12,119,827	2,367,642	3,112,309	2,332.002	22,978,992		34,371,294

In the 22 years shown above we have spent on new construction £11,392,300 more than France—or at the rate of £517,800 a year.

* Inserted from estimates.

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In the four years 1880–4, £1,000,000 in round figures had already been added to our gross estimates for the Navy. In his speech in moving the Navy Estimates for 1886–7, Mr. Hibbert gave the total net estimate as £12,993,000, or an increase of £606,000 over the grant of 1885–6, and £298,000 over the grant and the Supplementary Estimates for the same year. Having appealed to the advocates of economy, he appealed also to those who were in favour of increased estimates, and asked them to consider how much had been done for the Navy during the last two years. In 1885–6 the Naval Estimates amounted to £12,694,000, or an increase of £1,127,000 over the previous year. In addition, out of the Vote of Credit, there was spent on shipbuilding work no less a sum than £1,014,000, or more than £2,000,000 over 1884–5. "If," he said, "you take the expenditure for the last twelve years, dividing it into two periods and omitting the Votes of Credit, you have an aggregate sum of £66,802,000 spent on the Navy during the six years from 1874–5 to 1879–80, when a Conservative Government was in office, or an average of £11,133,000 per annum, being less than this year's Estimate by the sum of £1,859,000—and an aggregate sum of £69,030,000 during the six years from 1880–1 to 1885–6, when a Liberal Government was in office, or an average of £11,505,000, and less than this year's Estimate by £1,488,000. When I mention Conservative and Liberal Governments, I do not do so for any party purpose, but because it may be useful to honourable members who want larger estimates to know what their friends did for them during that period. Then I will ask honourable members to look at the large number of ships now under construction. There are at present in progress 103 different ships—20 armoured ships, 4 protected ships, 25 unprotected, and 54 torpedo boats. In addition I would say that the liability for the large number of vessels which are now being constructed amounts to the sum of £13,155,000. I do not suppose that at any previous time in our history has there been so large a liability for the work of shipbuilding during the time of construction, with a further sum of £1,138,000 for guns."

Action taken by Lord Northbrook.

From the commencement of Lord Northbrook's Administration our armoured building had been gradually increased, and in this, the most costly element of our naval power, we held throughout his Administration a not unsatisfactory position. In the construction of the torpedo flotilla, which has recently acquired so much importance, other nations have until lately been doing more than England, and for the defence of our commerce against privateers it is highly desirable that the Navy should be more thoroughly prepared.

Demands on Navy.

If we look to the magnitude of the interests at stake, to the value

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of our shipping and our sea-borne trade, to the extent of our Colonial Empire, to the dispersion of our naval forces in time of war, whilst an enemy may concentrate on a single point of attack; and if, lastly, we look to the dependence of our population upon imported food, it is impossible to affirm that any naval force which we could maintain in peace would be adequate to our requirements in war. But if we examine the question from another point of view,—if we compare the amount which Parliament is now asked to place at the disposal of the Admiralty with the means available elsewhere,—the estimates on the scale which we have reached within the last two years should in the course of time be sufficient, under good administration, to secure a commanding position.

Estimates sufficient.

Comparison of shipbuilding votes—France and England

The shipbuilding votes for the French Navy for the past and the present years yield, in round figures, three millions sterling. Our shipbuilding votes, including the vote of credit for the corresponding period, amounted to £5,342,770 and £5,457,617. These figures include the charge for repairs and machinery.

The cost of building being certainly not greater on the whole here than elsewhere, the annual additions to the Navy may be taken as proportionate to the expenditure.

In the near future we may look for a reduction rather than an increase in the expenditure on the French Navy. The financial resources of France have of late been strained to the utmost. The expenditure on public works has been cut down by one-half, and a heavy loan is about to be issued. These are not conditions in which we anticipate an increased expenditure on a service which is not for France, as it is for England, her first line of defence.

Our policy to keep ahead of other Powers.

It should be accepted by the administrations of the two countries that the shipbuilding votes should be maintained in their present relative positions. An understanding to this effect would prevent a costly rivalry. It would be in vain to increase expenditure, if it were known that the relative position could not be improved. On the other hand, those responsible for the naval department in this country will find ample justification for a large expenditure in the enormous value of the interests confided to the protection of the British Navy. It is a natural anxiety which possesses the people of this country with reference to the Navy. Every attempt at reduction has been followed, at a short interval, by a scare in which our national dignity has been seriously compromised, and by a renewed and irresistible demand upon our financial resources.

In 1869–70, the Navy Estimates were reduced by more than £1,000,000. In 1870–71, they were again reduced from £9,680,000

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to £9,133,000. They were as suddenly increased under the same Administration to £9,718,000 for 1871–72. Four years later, under the succeeding Administration, they amounted to £10,653,000, or approximately the sum from which the reductions had been made in 1869–70.

The British public will not accept a policy of retrenchment in naval matters. The best, as it is in the end the most economical, course, is to keep well ahead of other Powers. The deliberate wisdom of England is truly reflected in the spirited sentiment of M. Turgot:

"S'il ne peut y avoir de dépenses publiques, s'il n'y a point de forces communes pour employer à l'intérêt commun, il n'y a point d'État à proprement parler; il y a seulement une contrée peuplée d'habitants qui naissent, vivent et meurent, auprès les uns des autres."

The only form of economy which is really popular in this country is that which consists in strenuous efforts to give the most effective application to the expenditure of money; but if other Powers will take the initiative, we shall be ready to follow in a policy of retrenchment.

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CHAPTER IV.

General Efficiency of the British Naval Administration.

Efficiency of the Naval Service.

HAVING considered our Naval policy with reference to the amount of the Estimates, we have next to consider whether the administration is efficient. On this, one observation may be made which cannot be challenged. The Navy has never failed when it has been called upon to undertake a warlike operation. Readers of the history of the Crimean War will remember the glowing terms in which Mr. Kinglake contrasted the perfect efficiency of the Navy with the want of preparation of the Army; but it is not necessary to go far back in history for proofs of efficiency. We have them in the admirable manner in which the novel and difficult experimental work was carried out by the evolutionary squadron last year. We have them in a still higher degree in the serious operations of war on the coasts of Egypt, in the Suez Canal, and on the Nile. On shore the Marines, an Infantry force organised under the Admiralty, have won universal praise. We shall not hesitate to claim its share of credit for the department of the Admiralty which is responsible for the Transport service. When a sudden demand was made upon them, under the apprehension of a war with Russia, they were ready at all points; they knew precisely where to lay their hands upon the most suitable ships for conversion into cruisers in all parts of the world. They had ample information as to every available ship at home. A careful collection of drawings at the Admiralty rendered it possible to provide the armaments without delay; and the commercial arrangements were made with a due regard to economy. Under the extreme pressure of work, with necessarily incomplete information as to the charges incurred in India, China, Australia, and elsewhere, and in the utter uncertainty, from political circumstances, as to the future requirements for Transport service, their estimate of liabilities was imperfect; but the circumstances may fairly be pleaded in extenuation, and such was certainly the view taken by Lord George

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Hamilton, under whom the officials concerned continued to discharge their responsible duties.

Dockyards. Comparison of results.

The Executive Department at the Admiralty and the Dockyards have long been the best abused departments of the Government. There is, doubtless, large room for improvement, but in justice to the officials, whose good name is at stake, let us compare the results attained in England and elsewhere.

Designs.

Let us begin our examination by considering the most recent developments of shipbuilding for the Navy. The distribution of armour in the ironclads has been severely criticised; it is matter of controversy among the ablest naval architects. The subject is one of extreme difficulty, upon which it seems impossible to decide, *ex cathedrâ*; but there are other qualities, as to the value of which no controversy can arise. The essential importance of speed as an element of fighting efficiency cannot be disputed. In this respect marked progress has been realised in the recent designs. In the armoured battle-ships we have raised the speed to nearly 17 knots. The armoured cruisers Warspite and Impérieuse steam 17·2 knots, a knot more than was promised. The estimated speed for the belted cruisers may be taken at 18 knots on the measured mile. The French Vauban, the last ship which has been tried, steamed only 14·3 knots with forced draught.

In unarmoured construction great improvement has been accomplished. Those slow gun-vessels designated by the French critics as a *poussière navale*, have been cleared out of the building programme, and fast and effective vessels have taken their place. Lord Northbrook and his colleagues followed the lead given by the Board, over which Mr. W. H. Smith presided. They built the four ships of the Leander type, and the four ships of the Mersey type. All these have realised a speed of at least 17 to 18 knots on the measured mile. At a later stage they gave a large development to the torpedo flotilla.

The rapid progress in the improvement of the designs for the unarmoured vessels may be best appreciated by a comparison of the list of ships building and completing in the shipbuilding programme in successive years. The programme for 1880–81 included twenty-nine unarmoured vessels building and completing in the dockyards, and nine vessels, exclusive of Dockyard craft and torpedo boats, to be built by contract. Of these thirty-eight vessels, only two were capable of steaming 14 knots, and twenty were gunboats with a speed of 10 knots. In the programme 1884–5, the number of small vessels was reduced to twenty-five, but of these twelve were 17-knot vessels.

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Time for completion.

Passing from the designs of ships to the practical work of construction, the public has been impatient, and not unreasonably so, at the delays in the completion of ships. These delays have been caused, not by maladministration in the dockyards, but by the difficulty of settling many complicated details relating to armament in a period of transition. They are mainly attributable to those demands of the Navy for perfection which it must always be difficult, and often unwise, to refuse. If we compare the rate of progress in England with the rate of progress in France, where the modern breech-loading system was adopted years before it was accepted in the British Navy, we find that their time for the completion of ships has been much longer than ours. Taking the ironclads included in the French programme of construction for 1886, omitting the Brennus and Charles Martel, the construction of which has been temporarily suspended, the dates of the commencement of the ships, and their state of advancement on the 1st of January, 1886, are as follows :—

Name of Ship.	Tonnage.	Date of Commencement.	State of Advancement on the 1st of January, 1886.
Neptune . . .	10,581	1880	$\frac{46}{100}$
Formidable . .	11,441	1879	$\frac{85}{100}$
Hoche . . .	10,650	1881	$\frac{58}{100}$
Magenta . . .	10,581	1881	$\frac{40}{100}$
Marceau . . .	10,581	1881	$\frac{40}{100}$
Requin . . .	7,200	1878	$\frac{90}{100}$

If we turn to the English shipbuilding programme, we find the following :—

Name of Ship.	Tonnage.	Date of Commencement.	State of Advancement on the 1st of January, 1886.
Anson . . .	10,000	April, 1883 .	$\frac{57}{100}$
Camperdown . .	10,000	December, 1882 .	$\frac{47}{100}$
Collingwood . .	9,150	February, 1880 .	Both practically completed.
Edinburgh . .	9,150	March, 1879 .	
Howe . . .	9,700	June, 1882 . .	$\frac{71}{100}$
Rodney . . .	9,700	February, 1882 .	Practically completed.
Impérieuse . .	7,390	August, 1881 .	
Warspite. . .	7,390	October, 1881 .	

The rate of advancement for ironclads in the English dockyards shows a marked superiority over the rate of construction in France. Not a single ironclad laid down by the French during the term of office of Lord Northbrook's Board has yet been launched.

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If we make a similar comparison in reference to cost, while we acknowledge that in too many instances our original estimates have been largely exceeded, the excesses we have had to face are not so formidable as the figures with which foreign administrations have had to deal. In France the constant revision of estimates, often resulting in immense additions to expenditure, has again and again called forth remonstrances from the Legislative Chambers and professional critics. Cost.

It is stated in the Report of the Committee of the French Chambers on the Naval Estimates for 1882, that the programme of construction adopted in 1872 was originally estimated to cost £16,400,000. This figure had swollen to £29,720,000 in 1881, and it would probably reach £40,000,000 in 1885. In Italy, for the ten years' programme of building for the period 1877 to 1887, the original estimate was £5,840,000. In 1882, the excess upon the original estimate had already reached the formidable sum of £1,981,812.

It is evident from these figures that the same causes which have led to an increase in the cost of shipbuilding for the British Navy have led to a still greater increase of expenditure under foreign administrations.

Confining ourselves to battle-ships, the cost per ton weight of hull has increased from £48 for the Devastation, constructed in 1869–73, to £68 per ton for the Dreadnought, constructed between 1870–79, while the cost is £80 for the Collingwood, and £72 for the Camperdown. The tons weight of hull in the Devastation, Howe, and Rodney, are identical, but the cost for materials has increased from £182,000 to £250,000, and for labour from £106,000 to £205,000. The increase is distributed over all the elements of cost.

The increased power of the gun has led to the substitution of compound for iron plates. The mean cost of the armour per ton was £50 for the Devastation, £95 14*s.* for the Colossus, and £95 12*s.* for the Collingwood and Rodney. Again, the weight of the guns having been advanced beyond the capability of manual labour, at first steam, and more recently hydraulic power, has been substituted. The cost of the hydraulic gun mountings in the Collingwood is £43,155, and in the later ships of the same type no less than £75,000, a large sum for which there was no corresponding charge in the ships of the date of the Devastation. The Admiralty look to the private trade for the supply of machinery of this description. It is of comparatively recent introduction, and as yet remains the speciality of the Elswick firm. In process of time we may anticipate competition and reduced prices. Gun carriages are already supplied to the Navy from Woolwich and the private trade.

More speed is demanded, and increase of speed in a vessel of a

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form adapted to a powerful armament and heavy armour necessitates a large addition to the power of the machinery.

The propelling machinery of the Devastation cost £63,200, of the Colossus £93,433, Collingwood £87,500, and Howe £103,000. A comparison of vessels in the unarmoured programmes of recent years with those of earlier date goes far to explain the increase in the cost of building. The improvement of speed has been the result, partly of the acceptance of dimensions and forms more favourable to high speed, and partly of the great additional power of the machinery. To raise a speed of twelve knots to fifteen knots requires about double the horse-power, and consequently double the cost of engines.

More minute internal sub-division is required for the purposes of defence against the torpedo, while the use of torpedoes offensively demands fittings of a most complicated character. These are further causes of increased expense.

The increase in the calibre of the heavy guns, with the consequent necessity for hydraulic loading, the addition of a large superstructure, the light broadside armament, the machine guns, the torpedo fittings and electric lights, have been forced upon us by the progress of invention, and the result has been an enormous addition to the cost, and an ever-increasing difficulty of maintaining the output of tonnage at the amount laid down as necessary by Mr. Childers, when First Lord of the Admiralty. Twelve thousand tons of Devastations would have cost £576,000; twelve thousand tons of Collingwoods cost £960,000.

It has been the steady aim of the Admiralty to realise the building programme proposed in the Estimates. It has only been possible to accomplish this object by an excess in the expenditure on wages in the dockyards over the amount taken in the Estimates. The pressure arising from the increasing cost of building, especially in the completing stages, where questions of gunnery came in, is shown from the fact that the excess of expenditure on construction over the estimated amount in the five years, 1879–84, was no less than £276,000.

Repairs. The charge for repairs is one of the most difficult to keep under control, whether in public or private administrations. Piecework cannot largely be introduced, and with no stimulus derived from direct personal interest, and under supervision not always sufficiently vigilant or authoritative, much time may be spent in idleness.

Comparison with France. We find the same defects under other Governments. Statistics resulting from an official comparison between France and England formed a prominent feature in the Report of the Committee on the

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French Estimates for 1879. The writer, M. Lamy, showed that while the tonnage of the Fleet in commission was 250,000 for England and 170,000 for France, the cost of maintenance and repair of the Fleet was for England £440,000, and for France £540,000. In England 20,000 workmen were employed in the dockyards and in the Administrative services as against 25,000 in France.*

The following are examples of completed ships of approximately equal tonnage:—

Name.	Date of Launch.	Displacement.	Cost of Hull.
			£
Amiral Duperré	1879	11,100	460,000
Dreadnought	1875	10,820	493,035
Devastation	1879	10,100	291,000
Thunderer	1872	9,330	306,346
Redoutable	1876	9,200	356,000
Ajax	1880	8,510	415,000

M. Dislère, Ingénieur des Constructions Navales, a well-known writer on professional subjects, has minutely compared the Naval Expenditure of France and England. The results were published in 1878 in his essay, *Les Budgets Maritimes de la France et de l'Angleterre.*

The following statistics are taken from this source:—

Page.		England.	France.
		Tons.	Tons.
73	Ships in commission	309,000	187,900
	Ships in reserve	60,000	19,400
80 81	Tons proposed to be built in dockyards	13,500	19,700
82 83	Personnel:—		
	For supervision	776	3,414
	Workmen	16,000	21,950
	Total	16,776	25,364

Making allowance† for the larger amount of tonnage proposed as above to be executed in the French yards, it would appear that the 16,776 workmen in the English yards could execute an equal amount of building, and maintain a far larger tonnage in repair than

* In the appendix to a report by Commander Chadwick, U. S. N., on the training of seamen, published in 1879, the following figures are given:—

Various functionaries in civil employment in French dockyards	2,244
Maistrance et Surveillance	2,389
Workmen, naval construction	22,273
Civil Engineer department	770

† It is assumed in the British dockyards that each workman employed on building represents a construction of 2½ tons per annum.

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22,884 workmen employed in the French dockyards. Making every allowance for inaccuracies of detail, these figures do not support the assertion that construction is less costly in France than in this country.

Elsewhere (pp. 106–7) M. Dislère remarks that while the average daily wages are for English workmen 6 fr. 7 c., and French 2 fr. 58 c., the annual cost of repairs per ton of displacement is, England 49 fr., France 46 fr. 50 c., and (p. 109) the cost of building ships of war, by contract, approximately the same in both countries. The subject is fully discussed in the Report of the Committee on the French Naval Estimates for 1879, prepared by M. Lamy. See pp. 42–45, also p. 34 as to the impolicy of undertaking too large a number of ships simultaneously. The Committee were distinctly of opinion that the ship-building operations are carried on at an excessive cost in the French dockyards.

United States.

In America much extravagant expenditure on repairs has been recently disclosed by an official enquiry. Mr. Whitney, the Secretary of the United States Navy, in his Report to the Board, of November 1885, makes the startling statement that since 1868 the United States have spent over £15,000,000 sterling on the construction, repair, equipment, and ordnance of vessels, "which sum, with a very slight exception, has been substantially thrown away." Mr. Whitney gives examples of how the money has gone. The Omaha has been rebuilt within the last four years at a cost of £114,400. For this outlay the United States have obtained "a repaired wooden vessel, with boilers, machinery, and guns, all of which would at the time have been sold for what they would have brought by any other nation on earth. In the event of a war she can neither fight nor run away from any cruiser built contemporaneously by any other nation. Her rebuilding cost the full price of a modern steel ship of her size and all modern characteristics."

While our efforts to improve should be persistently sustained, we may infer from these comparisons that we get a better result from the expenditure of public money than is secured elsewhere.

We may conclude with a few considerations of a general character. In criticising the administration of the British Navy, due regard should be had to the continued demands which are made upon the fleet for the police of the seas, for scientific research, for the prevention of the slave trade upon the coast of Africa, and of kidnapping in the Islands of the Pacific. Lastly, considerations of training become prominent in a long peace. Hence we find a natural tendency to build vessels which may be admirably adapted for the ordinary duties

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of the Navy in time of peace, but by no means effective as men-of-war. The public can have no adequate conception of the heavy cost which has been incurred by those responsible for the British Navy in the performance of services which are essentially of a pacific character.

During the twenty years 1864–84, while France expended £23,000,000 sterling on new ships and their machinery, the expenditure in England was upwards of £34,000,000.

That any doubt should exist as to the superiority of a Navy upon which, in twenty years, eleven more millions has been spent than upon that fleet with which it is now compared, that any controversy should be possible on such a subject, is a fact which calls for some explanation. That vast expenditure of £11,000,000 has been devoted mainly to the fleet built for the police of the seas and the protection of commerce. England has taken upon herself a heavy charge, from which the whole civilised world has derived incalculable advantage, but which gives us nothing to place in the balance when comparisons are made of the effective strength of fleets for the line of battle.

Those responsible for the administration of the British Navy may further point to the heavier charges, which, under a system of voluntary enlistment, must necessarily be borne for the pay of the seamen. On the vote for wages, we have an excess in the British Estimates over the French of more than £500,000.

The more exhaustively the expenditure on the British Navy is criticised and compared with that incurred under other Governments, the more clearly it will appear that there are inherent difficulties in the management of industrial operations by a public department; and that the British Admiralty have been at least as successful as any foreign Administration in their endeavours to secure economy and efficiency.

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CHAPTER V.

Suggestions for Reforms at the Admiralty and in the Dockyards.

Admiral Graham's Committee.

While contending for justice to the administration of the Navy, it must be admitted that the difficulties inherent in the management of industrial establishments by a Government Department, have not been by any means completely overcome in our English dockyards. In connection with the general revision of accounts the late Government directed an inquiry to be held by a Committee, of which the present Controller was the Chairman. In their Report they called attention to defects that have engaged the attention of every Committee and Commission which has from time to time been entrusted with a similar inquiry. The overgrown clerical establishments, the duplication of returns, the absorption of the valuable time of the principal technical officers in office duties, many of them mere formalities, when their personal presence is urgently needed for the active duties of supervision, the want of direct authority over the men, and the absence of any direct pecuniary encouragement to exertion, all these are points on which the Committee of Admiral Graham very properly insist. The same defects were pointed out, and almost in the same language, in the Report of the Committee on Dockyard Economy, of which Sir Robert Smart was the Chairman. An interval of more than a quarter of a century shows no substantial change in the administration of the dockyards. In many portions of the latter Report, the language of the earlier document is almost textually reproduced.

Departmental Committee.

Admiral Graham's Committee proposed considerable changes. These were referred to a Departmental Committee, of which Mr. Ritchie was the Chairman. Numerous reforms were recommended.

The Accountant-General.

It will be observed with satisfaction that it is not proposed to create a new permanent officer, to whom the Accountant-General would have been subordinate. Such a change would have tended to weaken rather than to strengthen his responsibility and his power of control. It would have been a retrograde step. A more strict recognition of his

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authority over all branches of the Admiralty was wanted, and it has been secured under the new regulations.

The position of the Accountant-General, like that of any other highly-placed official, must always depend upon the personal qualities of the individual holders of the post. A strong man will make his presence felt, and will exercise an authority greater perhaps than is afforded by the strict letter of the regulations under which he is working. In a technical sense the position of the Accountant-General may not have been sufficiently defined under the former regulations, but all who had the honour of serving at the Admiralty at the time when Sir Robert Hamilton was the Accountant-General, must have felt confidence in his power to deal in an authoritative manner with all the duties which fell within the range of the department over which he presided. The present Accountant-General has a long and honourable record of public service, and strengthened as he now is for his work, we may confidently look for much useful criticism of expenditure, and an exact record of liabilities.

Personal explanation.

The following personal explanation, taken from a speech delivered to his constituents by the compiler in 1885, may be appropriately inserted: "Before I enter upon a general statement with regard to the administration of the Navy under the late Government, it will be proper that I should offer some explanations with reference to the failure of a particular branch of the Admiralty—I allude to the Transport Department—to keep the officials who are responsible to Parliament accurately informed as to the amount of expenditure which had taken place, and as to the liabilities and charges incurred in connection with the Vote of Credit. The failure of the Transport Department was distinctly a failure in regard to the statement of liabilities incurred. It has never been contended by the members of the present Government who spoke on the subject in the two Houses of Parliament that there had been any extravagance on the part of the Admiralty. It was the duty of the Admiralty to give effect to the policy which had been adopted by the Cabinet; to fit out a fleet of cruisers to protect our commerce; and to hire a sufficient number of transports to convey the troops to and from Egypt. It has never been contended that the number of cruisers and transports which were hired was excessive, or that the rates which were paid were extravagant. No question has been raised as to the judgment shown in selecting the vessels. It has been admitted that the ships were the best which the mercantile marine had to offer for the purposes for which they were required. The failure, briefly stated, consisted in this: that the transport branch did not make the parlia-

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mentary officials of the Admiralty acquainted as promptly as they should of the liabilities which had been incurred.

"I will now proceed to offer an explanation, by tracing very briefly the history of the case. Parliament had voted for the purpose of naval and military preparations, in view of the possibility of a great struggle with Russia, £11,000,000 sterling. Of that sum, £2,800,000 were allotted to the Admiralty; £1,800,000 were to be applied to the general preparation of the Navy for the contingency of war; and £1,000,000 for the hire of cruisers for the protection of commerce, and for transports to be used in the conveyance of our troops. In dealing with the larger sums, the distribution of expenditure was arranged by Lord Northbrook, in consultation with, and under the advice of, the heads of the several departments into which the business of the Admiralty is divided. Those sums were not distributed at random; they were carefully and closely considered with reference to the orders which had been given for the fitting out of ships for the sea service; with reference to the additions to be made to the armaments of the ships, and to the orders that had been given for the completion of our establishments of naval stores, both at home and abroad. Dealing first with the expenditure of this sum of £1,800,000, notwithstanding the very great pressure which was put upon the various naval establishments, there was no excess in any branch of the naval service beyond the limits fixed by Lord Northbrook. It is in the administration of the dockyards that the authority of the Controller of the Navy, the Secretary of the Admiralty, and the Civil Lord of the Admiralty is more particularly felt. In this department we succeeded in doing what had been expected of us. We had no excess. The ships were ready to the day.

"Let us turn to the mode in which the sum of £1,000,000 sterling for the hire of transport was arrived at. In estimating the probable cost of the hiring of transports, it was in the nature of things quite impossible that we could beforehand frame an estimate even with approximate accuracy. We did not know the number of troops that would be conveyed; we did not know how long they would be retained in Egypt; we did not know the port or ports to which the troops would be conveyed. With regard to the cruisers for the protection of commerce, it was not known beforehand how many of those ships would be required. We did not know in what quarter of the globe they would be required, nor whether they would be manned by the navy or by merchant crews. In fact, all the data necessary for an accurate estimate were wanting. The sum taken was a mere guess, and practically nothing more than a vote on account.

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"Having explained the basis upon which this estimate is formed, I shall proceed to state the steps which were taken in order to secure that those officials of the Admiralty who are responsible to Parliament for the expenditure of the public money should be informed of the liabilities incurred. For this purpose the Accountant-General was instructed to place himself in communication, at frequent intervals, with the heads of the departments, and week by week he was to place before us a statement, showing in two parallel columns the amounts appropriated to the service of the Navy, and the expenditure and the liabilities incurred under the several heads of charges. In accordance with those instructions, every Monday morning there was laid before Lord Northbrook, myself, and Mr. Caine, the Civil Lord, an account, the nature of which I have explained.

"The estimate for the hire of transports was originally from necessity a mere guess, but it was a sum with which a great deal could be done. When, therefore, that statement of liabilities, rendered to us week by week, with respect to transports, did not exceed the original sum of one million, which had been taken for the purpose, I saw no reason to doubt that it had actually covered the liabilities incurred. I had given orders for the preparation of a weekly statement of liabilities. I relied, and I was fully justified in relying, upon the faithful and punctual execution of my orders. The officers immediately concerned were officials of the highest rank in the service of the Admiralty; they were the Accountant-General and the Director and Assistant-Director of Transports. I placed implicit confidence on their periodical returns. So did the two Accountants-General, who were responsible for the preparation of the weekly returns. I looked for accuracy in the returns of liabilities under the Vote of Credit no less than in the case of any other return periodically rendered to the Admiralty. The weekly return of expenditure in the dockyards, the statements of expenditure on works and stores, the return of the numbers borne of blue-jackets, marines, and boys, are accepted with implicit confidence by the Board, and by the Parliamentary Secretary. The conduct of the business of a great department would become utterly impracticable if we could not put our trust in the fidelity and the accuracy of the returns ordered from the several branches. Certain it is that the Accountants-General, Sir William Willis and Sir Gerald Fitzgerald, thought themselves justified in acting in that spirit of confidence in the execution of the orders which they had received from the Board, directing them to prepare their weekly statement of liabilities. Let us turn to the evidence upon this point. Sir William Willis says, at

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Question 997, 'I felt the utmost reliance on the Transport Department. I have known the department for very many years; I was myself chief clerk in it for sixteen years; it had for many years one of the most able officers of his day, Sir William Mends, at the head of it. I have also known the Assistant-Director, Mr. Baughan, for many years, and I felt the most thorough confidence in the financial statements I received from him.' Asked at Question 1020, 'From your knowledge of the Transport Department and the arrangements, would you be surprised if liabilities had been incurred in that department which had not been brought into account by that department?' he replied, 'Certainly, and such has been my confidence in the officers administering the Transport, that I should fully anticipate that they would be prepared to afford an explanation.'

"The same confidence in the returns presented by the Transport Department was expressed by Sir Gerald Fitzgerald, who, although newly appointed to the post of Accountant-General, had served for twenty-nine years in the Civil Service. At Question 1333 he is asked, 'The information given under the former return by the Director of Transports stated that in his view, according to his information, the entire amount of expenditure and liabilities upon the 4th of June came within the amount provided by the Vote of Credit? A. Certainly that was the impression he left upon me. Q. And you would suppose, from his statement, that it did include, not only the actual payments, but that it included the known liabilities, the estimated liabilities there, and the estimated liabilities up to the end of the year? A. Liabilities, as far as they were known to him, as being the immediate liabilities upon the Admiralty.' Sharing in the confidence expressed by the officials whose opinions I have quoted, I did not think it necessary to cross-examine the Director or Assistant-Director of Transports as to the accuracy of their returns. I saw the Assistant-Director frequently on other business, and that officer had every opportunity of giving an explanation to me if he had felt that the returns which he was sending in weekly were calculated to convey a false impression.

"I will not trouble you with further details upon this subject, but would remind you that the question was referred to a Parliamentary Committee which was presided over by my friend, Mr. Goschen. The sum originally allocated to the Admiralty for special war preparations was £2,800,000. What was the final verdict of the Committee as to the amount of the excess within the period for which the Government was responsible? They reported as follows: 'A more vigorous inquiry into possible and probable liabilities

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before June 4th would, in the judgment of your Committee, have revealed the necessity for asking for a larger sum than £2,800,000, though possibly not to a very large extent. After June 4th it would have been expedient to place on record the general calculation upon which the statement of Parliament was formulated. Had this been done they say it would have been manifest at once that a portion of the excess was ascertained, while another portion of the excess was due to causes over which Lord Northbrook had little control.'

"I fully and entirely accept the verdict of that Committee with regard to myself; I might, no doubt, have pushed inquiries more closely than I did. I did not push those inquiries because I had the fullest confidence in the officials, and because, in dealing with the emergency of sudden war preparations, Lord Northbrook thought it necessary to assume the entire direction and responsibility for the transport arrangements.

"On reviewing our experiences in dealing with the Russian preparations, it is obvious that a means might have been devised for keeping the Parliamentary Secretary apprised of all the orders given to the various departments involving charges under the Vote of Credit. A return of all such orders should have been sent to the Parliamentary Secretary daily, by the heads of each department, together with the best estimate that could be formed of the amount of liability which would be incurred in the execution of each order. Had instructions to this effect been issued *pari passu* with, or subsequent to, the order for the preparation of the weekly return of liabilities, we should not have had occasion for those explanations and inquiries which have tended to shake confidence in the department, and to bring some discredit upon officers who discharged their duties with great energy and ability, and never thought of sparing themselves in a time of great pressure and anxiety."

Estimates for 1886–87.

In connection with the reform in the office of the Accountant-General of the Navy, some reference should be made to the improved form in which the Estimates for 1886–87 have been presented to Parliament.

The Appendix.

The Appendix relating to ships building for the first time gives a summary of the total expenditure proposed, both for labour, materials, and machinery, for each ship in construction. The estimates in the old form gave the expenditure for labour in one appendix, and for machinery in another; but no information was given as to the total cost of the materials to be worked into the ships.

The form of statement now given in our Estimates is similar to that adopted by the French, though the information is not as yet given in the same convenient form.

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There are some other Tables which the Admiralty might with great advantage introduce. The French Estimates give in an appendix the cost both for repairs and manning of each ship in commission on the home and on the several foreign stations. We have no such information in our Naval Estimates, digested and available for immediate reference, and it would take some time to obtain it in office. In another appendix, the French Estimates give a list of all completed ships in the Navy, with the cost, in separate columns, of the hull, the machinery, the equipment, and the armament. This information is brought together for use at the Admiralty in the "blue list" of ships. The principal figures in the blue list should be supplied to Parliament with the estimates.

The French give in a "note préliminaire" an exhaustive summary of the policy embodied in the Estimates. We reserve this statement for speeches in Parliament.

A careful study of an official paper circulated with the Estimates would do more than any speech, however able, to assist in the consideration of difficult questions. The introductory statement might be supplemented, as Sir Spencer Robinson has suggested, by a report from the First Sea-Lord on those numerous and important subjects which must be determined mainly on his advice. A similar report could be prepared by the Controller on the matériel of the fleet. Documents of this kind are presented every year to the Secretary of the United States Navy, and circulated officially. Such reports would not only supply to the country many valuable suggestions, but would give those highly placed officials by whom they were prepared a direct and personal responsibility for the policy carried out on their advice.

Select Committee.

There is one other point in the practice of the French in dealing with the Navy Estimates which is well worthy of adoption in this country. It is the invariable custom to refer their Estimates to Select Committees of the Chambers. By these committees the Estimates are subjected to an exhaustive examination. In France the principal officers of the Admiralty are examined and called upon to justify their Estimates by explanation in detail; and to them we owe a series of invaluable reports on naval administration. Any returns, or any information of a general character, which may be required by the Committee, are furnished by the responsible department. Under the French system, parliamentary control is thus brought to bear on the administration of the Navy more directly than in this country.

Supervision in Dockyards.

In passing from the department of the Accountant-General to the dockyards, it may not be superfluous to remark that we must not rely too much upon mere account-keeping. If labour has been misdirected

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on alterations and repairs, and if time has been idled away for want of supervision or due encouragement to exertion, the loss will not be made up to the taxpayer by minuteness of tabulation and record. The cost of ships must depend primarily on the administration of the yards, and the supervision of the workmen on the part of the professional officers.

For the general management of the dockyards, the Admiralty have approved the appointment of a new officer on the staff of the Controller. They may be congratulated on the selection of Mr. Elgar, and let us earnestly hope that he will not yield to those fatal influences which have too often diverted the energies of officers from work of real importance into matters of official routine. We want less work on paper, and more personal activity on the part of those to whom we look for the direction of the dockyards. In the yards, as in Whitehall, the tendency is too much to sit in an office and to delegate the direction of large bodies of workmen to subordinates whose standing is not sufficient to invest them with the needful authority.

Professional assistants.

The creation of the new place of professional Assistant to the Admiral Superintendent of each of the large dockyards is another important change introduced by the late Board. The new officers are to receive £1000 a-year. Parliament will not grudge a liberal payment for responsible duties. But these officers must be sensible how much energy is required on their part to indemnify the country for the increased charges for salaries.

Promotion of foremen.

It appears from the Report of Admiral Graham's Committee that foremen of approved practical ability have been debarred from admission into the Corps of Constructors. Such a result was contrary to the desires of Lord Northbrook and his colleagues, and not in accordance with the recommendations of the Committee on Constructors. It was one of their main objects to put an end to the system of selecting men for practical duties by a literary competition. Any regulations which bar the way to promotion for good practical men should be rescinded.

Rewards for special work.

Admiral Graham's Committee called attention to the ill effect of the present system which practically renders impossible the payment of any direct or special pecuniary reward to Foremen and Assistant Constructors for carrying out large and important works in a satisfactory manner. This recommendation could be supported by many instances which came under the writer's notice whilst serving at the Admiralty. He would particularly refer to the case of the Iron Duke. That ship was seriously injured on the coast of Japan.

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After examination at Hong Kong, it was the general opinion that the ship should be ordered home. The foreman of the yard at Hong Kong begged earnestly to be allowed to undertake the repair. By immense personal exertion he carried out the work successfully. The saving to the country may be put at tens of thousands of pounds, but no reward being permitted under the regulations, none was paid to this deserving officer. The Admiralty should be invested with more discretionary power for rewarding exceptional services. It is this want of discrimination between the men who work zealously and others who drift along the sluggish stream of official routine which paralyses the administration of public departments.

Promotion of leading men to Inspectors.

Passing from the foremen to the leading men, their promotion to the rank of Inspector was earnestly pressed by the principal officers of the Constructive Staff at Whitehall. The proposal was supported by the same arguments which were placed before Sir Robert Smart's Committee. It was urged that the leading men did not receive from their superiors, and consequently from the officers of the ships on board of which they were engaged, that consideration and respect that would tend to make them looked up to by the men under them, and that the position of those officers immediately superintending the men, and necessarily dressed in some degree as workmen, was not sufficiently upheld. In deference to these opinions, the Committee on professional officers recommended that the leading men should be advanced to the rank of Inspector, that they should be placed on salary, and receive some increase of remuneration. It would appear that the promotion of leading men was not carried out with sufficient discrimination. It is alleged that their authority has not been strengthened by their promotion, and it was perhaps scarcely reasonable to expect any very sudden change. Instances of weakness on the part of the inspectors should be dealt with firmly.

Labour in dockyards.

Having dealt with the officers, we may pass to the workmen employed in the dockyards. Under the existing system, the majority of these men are paid by time, and much of the work they do is of a nature which cannot be checked by measurement. In these circumstances supervision is the only check, and it is too often imperfect. The testimony obtained on this point by Admiral Graham was to him conclusive. Admiral Hornby, giving the results of his observation during his recent command at Portsmouth, said:—"I have no hesitation in declaring that the supervision of labour in Portsmouth Dockyard fails completely to obtain a fair day's work from the workmen." Captain Fitz Roy, in a similar communication, gave an instance in which he saw from the stern walk of the Hercules two

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men, supposed to be repairing the Sultan's hawse-pipes, reading a newspaper or sleeping from 1·30 P.M. to 3 P.M. His general impression as to the supervision of labour in the Dockyard was that it was very indifferent, owing to the want of trustworthy leading hands and their dread of making themselves unpopular.

Payment by results should be extended as far as possible. Much work will, however, still remain to be done which must be paid for upon the basis of time. In order to encourage and to reward diligence upon the part of the men so employed, Admiral Graham's Committee recommended that they should be classified according to ability.

In the engineers' branch men are paid at widely varying rates, and more elasticity is required in the payment of the thousands of men employed under the shipbuilding officers, and now receiving one uniform rate of wages, quite irrespective of wide differences in individual merit. Hitherto too much lenity has been shown in retaining idlers and incompetent men in the yards while the good workmen have gained no proportionate advantage. The system has deadened the energies of the men.

The evidence of two officers so distinguished as Sir Geoffrey Hornby and Commodore Fitzroy should not, however, lead us to unjust impressions as to dockyard workmen as a body. Where thousands are employed, there are doubtless many idle and inefficient men; but for the majority it may be claimed that, under conditions by no means favourable to steady labour, they give a fair day's work for a fair day's wage. Men of exceptional merit are not wanting; and, as to the excellence of the work done in the dockyards, no question has been raised.

Repairs.

The greater endurance of boilers through improved management, and the stronger system of construction recently adopted, the greater durability of hulls of iron, or steel, or composite, and the extended absence of vessels from the home yards, are gradually bringing about economy in repairs. Our well-equipped establishments abroad have been of marked advantage in enabling us to repair ships for a second commission. On stations where we have no large dockyard, we send out reliefs direct from England, and the vessels relieved proceed from the Cape to Bermuda, and from the Pacific to Hong Kong. At those yards they can be refitted for a second commission.

Having dealt with the economies which may be effected by an improved system of dockyard administration, let us turn to those which depend on the action taken by the Board of Admiralty. The subject of alterations and repairs was referred by Lord Northbrook to a committee for special inquiry. On their Report the late Board

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issued revised instructions for dealing with ships on paying off, which must prevent in the future much useless pulling down and reinstatement of fittings. It is not merely in the mode of dealing with ships on paying off that changes are desirable. We have to consider whether alterations are not undertaken which are not worth the heavy cost they entail.

Alterations. The demand for alterations in connection with the re-armament of the Navy has pressed heavily upon the resources of the yards in recent years. The constant drain upon the Admiralty for repairs, including alterations, has been a source of disappointment to every Board. Our ships are solidly built; the materials are durable; the service at sea is not excessive; and yet we find ourselves involved in expenditure upon our ironclads every ten years of amounts which sometimes exceed the large total of £50.000 to £60,000. For corvettes of the "C" class, or the "Gem" class, estimates for thorough repair have often exceeded £30,000. No re-armament should be sanctioned except in the case of a ship which we regard as effective for active service if we were at war with a first-class maritime power. Our unarmoured ships of the older types cannot fall within this category. For the most part they are deficient in speed, and where their speed is satisfactory they are not fitted with those internal subdivisions which have become essentially necessary as a defence against the torpedo.

Receiving ships. In connection with economy it is a question whether we ought not gradually to reduce the number of receiving ships and hulks, or to substitute buildings on shore. Do we require a receiving ship at Port Royal? How many ships are paid off and commissioned at that port in a year; and if a Depôt is needed for disposable seamen, would it not be better and far cheaper to substitute for the Urgent, which is constantly visited with epidemics of yellow fever, a sanatorium for seamen at the Military Hill station of Newcastle? At Queenstown the condition of the Revenge has for a long period been unsatisfactory. The state of the rigging is such that no drills can be attempted aloft, and the armament is of so obsolete a type that the instructors now sent to the ship find themselves quite unaccustomed to the work they have to do. As the ship is not available for drill purposes, it seems difficult to give any reason which would justify the retention of the vessel. The Revenge should be withdrawn, and a coast defence ironclad of the Gorgon type should be substituted. The staff attached to the officer in command at Queenstown should reside on shore.

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CHAPTER VI.

Foreign Squadrons.

Among the various reforms which will engage the attention of those charged with the administration of the Navy none is more urgent than a revision of our foreign squadrons. As at present constituted, our squadrons in foreign waters are unsatisfactory, whether regarded from the point of view of economy or of efficiency. Let us look first at considerations of efficiency. That war, whenever it may occur, will break out suddenly, leaving little time for preparation, is generally admitted. At the beginning of a maritime conflict the ships which perform the duties of our enormous carrying trade would be scattered over the whole wide surface of the ocean. It would be necessary to render available for the protection of our mercantile marine, with the greatest rapidity possible, the ships of war dispersed throughout the several Naval stations. No change has been introduced into the mode of distributing our ships, since our trade attained its present importance, and steam has so largely replaced the use of sails. The Admiralty should carry out gradually the withdrawal of ineffective vessels from the force permanently maintained in commission at foreign stations, and the substitution of squadrons of effective cruisers. Our foreign squadrons consist in large proportions of gun-vessels and gunboats. It will be admitted that vessels of this class, hitherto so inferior in speed to the slowest ships of the Mercantile Marine, contribute little towards the great objects of our Naval administration. Those objects are to guard our enormous maritime and commercial interests, and to maintain for England a commanding position on the ocean.

The mistaken application of the shipbuilding vote in past years in the construction of a large number of vessels of slow speed, absolutely inefficient in time of war, is much to be regretted. In point of cost those ineffective vessels, ton for ton, fall little short of the most effective of our ships. The extent of the demand upon the ship-

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building votes for the construction of gunboats may be appreciated from the fact that 7 sloops and 21 gun-vessels and gunboats were included in the shipbuilding programme for 1880–81—the first with which the compiler was officially connected.

The former misapplication of money in construction has ceased, but we have to carry the movement for reform from the building slips to the repairing basins of our dockyards. It is impossible to visit Devonport or Sheerness without carrying away a painful impression that the resources of those constructing establishments are still largely misapplied. In this as in every branch of the administration of the Admiralty, our policy must depend to a considerable degree on the action of other Powers. We have in commission 30 ironclads against 15 in commission under the French flag. The difference in our favour in ironclads is not disproportionate to the interests at stake. Of corvettes and large cruisers we have in commission only 26 against 18 under the French flag. In this class it is essential that we should be better prepared. In the number of smaller vessels in commission we have a great superiority, but these vessels are useless for the protection of commerce. It will be obvious that some considerable change is necessary in the character of the standing force of the British Navy. It must be brought about by the gradual substitution of a less number of vessels of greater individual power for ineffective gun-vessels and gunboats. We must not rest content with a re-inforcement of the foreign squadrons. We must have the means of further re-inforcing those squadrons promptly in an emergency. For this purpose a powerful reserve squadron of cruisers should always be available. The ships should be in commission, but not necessarily fully manned; they should be exercised sufficiently at sea; they should form part of the annual Evolutionary Squadron, and the organisation should be similar to that adopted for the reserve squadron of ironclads. The reserve squadron of cruisers would consist of the fastest in the Navy. They should be the ships on which we rely to defend our commerce in war. In addition to this Reserve Squadron of steam cruisers it is most desirable for the efficiency of the service to keep together in flying squadrons a certain number of ships of types well adapted to cruising under sail. It is satisfactory to know that we have one such squadron in the West Indies, under the command of Commodore Fitz Roy. This Atlantic Squadron should alternately visit the Cape, the North American, and the South-East Coast of American stations, returning to England every six months to clear out the ordinary seamen from our receiving ships, and to give to the men who have been some time at sea a

Reserve squadron of Cruisers necessary.

Flying Squadrons desirable.

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spell in harbour and necessary instruction in gunnery. Another flying squadron should be organised for cruising in more distant waters. As the passages at sea would be long, it is desirable that the ships selected for this service should be capable of maintaining a high speed under canvas. The three noble frigates, the Inconstant, the Shah, and the Raleigh, are eminently suitable. In ships of this powerful class, a voyage to the Antipodes or to the Pacific and China would easily be accomplished in a period of eighteen months.

In addition to these squadrons it may be desirable, in view of the withdrawal of the gun-vessels and gunboats from the foreign stations, to keep in commission additional sea-going vessels for training purposes. If we were content to accept sailing ships such as those in the French and German service, the necessary tonnage could be created at a moderate cost. If steam power is considered necessary, a design for a suitable ship might be obtained from the builders of our finest modern clippers. Sailing qualities being the primary consideration, neither a high speed under steam nor a heavy armament need be insisted upon.

It may be claimed for the plan recommended first that the occasional visits of a powerful fleet produce a greater political influence than the constant presence of the small vessels on which the British flag is now displayed in many foreign harbours; secondly, that men would be better trained in flying squadrons than in vessels permanently attached to a foreign station, and less actively employed at sea.

It would be another great advantage of the scheme that it would tend to reduce the length of commission. This again would lead to an important economy. The great expenditure on repairs in the Navy has been justified partly on the ground that when the ship is being prepared for a commission of five years it is necessary to condemn many things which might be passed as serviceable for a more limited period. There may be numerous instances in which a ship can be sent abroad for a period of two years at a slight expense, whereas it would be necessary to spend a large sum in order to keep her at sea for a longer term. It is needless to insist on the boon which would be granted to the Navy if men could be spared the severance of home ties for weary periods of three or four years. It has been shown again and again in the evidence taken by Commissions on manning, that the liability to long spells of service abroad deters seamen from joining the Navy.

The small vessels which it costs us so much to repair and to

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replace are comparatively useless for every other purpose except that of repressing the outrages of savage tribes and half-civilised nations. It seems but just that a task of such a nature should be apportioned among the Maritime Powers in proportion to the strength of their respective navies, their naval expenditure, their commerce, and the positions they have assumed from time to time in the negotiation of Treaties, and in the warlike operations which have preceded these negotiations. Unless an equitable apportionment of the responsibility of maintaining the police of the seas be made we shall remain burdened with an undue share of expenditure upon a class of vessels which contribute nothing to our strength as a Maritime Power, while rival nations will gain a greater accession of strength in proportion to their total outlay in building and manning their fleets.

Among the Maritime Powers should be apportioned the police of the seas.

The widely different measure in which the cost of the police of the seas is distributed, as between this country and France and Germany, is shown by a comparison of the strength of their respective fleets on several foreign stations. It seems reasonable to believe that a considerable reduction of gun-vessels and gun-boats is admissible, and that by negotiations with the different Governments whose subjects are close competitors with our merchants in a trade carried on almost exclusively under British naval protection, we might induce them to take their share in the protection of European interests. In the ports of semi-civilised countries, and in the Treaty ports of China, a fierce competition is carried on by German firms and agencies with the British merchants. The trade of Germany has hitherto been carried on in reliance on the protection afforded by British vessels of war. We bear an undue share of the burden of the police of the seas. The question calls for consideration and adjustment between the Naval Powers. If we could be relieved from a portion of our self-imposed task, it would enable us to expend our resources to more advantage on ships, which might be capable by their high qualities of speed of defending our commerce from the attacks of a first-class Power.

Among the duties undertaken by the Navy, for which it is necessary to employ vessels of a type not suited to the more important services which would be demanded from the Navy in war, I may particularly instance the police of the seas in the Persian Gulf. The service is most trying to British crews, and it could be performed efficiently by the Indian Navy in vessels manned by native crews under British officers. The contribution from the Indian Government, fixed at £70,000 a year, is a bad bargain for the British Admiralty. The changes which have been suggested would

Persian Gulf.

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be best carried out by a Departmental Committee, on which the Colonial Office, the Foreign Office, and the Admiralty, should be represented. This subject was brought before the House of Commons some years ago by Mr. Childers in an able speech; the cogent arguments urged on that occasion are equally applicable to existing arrangements.

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CHAPTER VII.

SHIPBUILDING.

TYPES OF IRONCLADS LAID DOWN, 1880–86.

Ironclads.

HAVING in a former section given the general statistics bearing on the shipbuilding for the Navy, we may turn to the question of type.

Lord Northbrook's Board had no arbitrary views as to dimensions, but if they did not lay down any fixed limit to the size of ships, they recognised the obvious objections to an indefinite increase of dimensions. As the size is increased, so the number of ships must be less which can be built for a given sum of money; and while the ships will be fewer in number, increase of size implies a loss of manœuvring qualities. The power of being able to give and avoid the blow of a ram by a rapid movement of the helm is a consideration of the utmost importance. An increase of size demands a corresponding development in all directions, including draught of water; and looking to the magnitude of our interests in the East, it is not desirable to build many ships for the British Navy which are excluded, by their draught of water, from a highway of the seas of so much importance as the Suez Canal.

Dimensions.

Every increase of displacement has been followed by a reaction. The Warrior, the Black Prince, and the Minotaur, vessels of nearly 10,000 tons, were followed by more handy vessels, for the design of which, in the earlier days of armour-building, Sir Edward Reed justly claims and is allowed so much credit. It was when other men did not see their way to produce ships combining protection by means of armour with manageable dimensions that the Duke of Somerset gave to Sir Edward Reed, then but a young and untried man, the important office of Chief Constructor to the Navy. In the years during which he served his country at the Admiralty, Sir Edward Reed produced a series of ships, of which the Devastation, 9,330 tons, was the largest example, descending through the Penelope to the Pallas, Favourite, Research, Viper, Vixen, and Enterprise. At a much later period the

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Admiralty, having allowed the dimensions of the ships to expand to the 12,000 tons of the Inflexible, felt the necessity of going back again to the 8510 tons of the Ajax, and the 9150 tons of the Collingwood.

In France, although the average dimensions have been less than with us, many distinguished authorities have opposed the use of armour, on the ground of the excessive dimensions it demands. We may particularly refer to the Committee on French Estimates of 1878; to able naval writers, such as the late Baron Grivel, Admiral Touchard (who occupied a position analagous to that of Controller of the Navy), Admiral Pothuau, formerly Minister of Marine; Admiral Penhoat, the author of an able treatise on Naval Tactics; Monsieur Dislère, a Constructor of the French Navy and the author of several well-known works; Monsieur Gougeard, the Minister of Marine under the administration of Monsieur Gambetta; and many others.

The question of limitations of dimensions was discussed in the French Chamber of Deputies on the 29th November, 1883. On that occasion the Minister of Marine, Admiral Jauréguiberry, spoke as follows:—

Speech of Admiral Jauréguiberry.

"Admiral Saint-Bon has been said to prefer greatly a ship like the Italia to vessels of inferior power, which are to be found in the Italian, English, and French Navies. It is now admitted that these vessels, with their heavy tonnage and deep draught of water, imposing such anxiety on those in command, are not as powerful and effective as it has been supposed. It is even admitted that two or three vessels considerably smaller will have no difficulty in giving a good account of them.

"It is further to be remembered that in recent years a novel feature has been introduced into maritime war. I refer to the torpedo boats.

"It is certain that vessels of this class are capable of placing the largest ships *hors de combat*.

"In France we have this year commenced the construction of sea-going torpedo boats, capable of steaming from 70 to 120 hours at 10 knots, and which on an emergency are capable of steaming at 18 to 20 knots. We are convinced that the ships they are now building in Italy might be placed in great peril by vessels of this class, and we are making great effort to supply our Navy with torpedo boats."

Opinions in Italy.

During a recent visit to the Italian dockyards, the compiler had an opportunity of ascertaining the views of several eminent members of the Italian Naval Administration. He was much impressed by

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the objections entertained to that excessive concentration of responsibility on a limited number of commanders which is a necessary consequence of the Italian policy of construction.

Policy of Lord Northbrook.

In quoting these authorities, it is not intended to express concurrence with their views. The object is to show that, while the Admiralty under Lord Northbrook did not recommend a policy which would deprive the British Navy of the immense superiority which armour gives to the armoured over the unarmoured ship, and while they were resolved that in the armaments of our ships there should be no inferiority, on the other hand they did not stand alone in proceeding with caution, and even with hesitation, in the advancement of dimensions. No increase in the weight of armour will give protection to the ironclad from the attacks of the torpedo in the circumstances which favour that puny but dangerous adversary. In foggy weather, in the night, in battle under cover of the smoke from the heavy guns, torpedo vessels will be with difficulty kept at bay; and, looking to the growing efficiency of the torpedo, a prudent Administration should hesitate long before committing itself to expenditure exceeding a million on single ships which cannot be made invulnerable.

The principles thus broadly stated will be generally approved. Both professional and non-professional opinion is opposed to the construction of vessels of war on the scale adopted for certain examples in the Italian Navy. In their practical application, Lord Northbrook's Board experienced the same difficulties which other Boards of Admiralty have found insuperable in keeping a check on the tendency to growth of dimensions. While no ship laid down by Lord Northbrook's Board was as large as the largest of the French ships, the average size of the ironclads in the British programme showed a considerable excess. Comparing the British programme of 1885–6 with that of the French Navy for 1885, we have the subjoined list (p. 55) of ironclads in construction.

It will be seen that we had fourteen ships of an average tonnage of 9521, while the ironclads building for the French Navy were fifteen in number, and the average tonnage for each ship was 8736.

Collingwood.

When Lord Northbrook's Board came into office, the last ship laid down by the preceding Administration was the Collingwood. The displacement of the Collingwood was 9150 tons. In the next two ships of the same type the tonnage was raised to 9600, and in the three succeeding ships, with no change of type, and solely with the view to secure greater fighting efficiency, the displacement was further increased to 10,000 tons.

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Armoured Ships in Programme.

English, 1885–6.	Tons.	French, 1885.	Tons.
Anson	10,000	Amiral Baudin	11,380
Camperdown	10,000	Indomptable	7,168
Collingwood	9,150	Furieux	5,560
Edinburgh	9,150	Duguesclin	5,869
Howe	9,700	Formidable	11,441
Impérieuse	7,390	Hoche	10,650
Rodney	9,700	Magenta	10,581
Warspite	7,390	Marceau	10,581
Hero	6,200	Neptune	10,581
Nile	11,940	Caiman	7,230
Trafalgar	11,940	Requin	7,200
Benbow	10,000	Brennus	10,600
Renown	10,470	Charles Martel	10,650
Sans Pareil	10,470	New ironclad	5,780
14 ships—Average per ship, 9,521 tons.		New ironclad	5,780
		15 ships—Average per ship, 8,736 tons.	
	133,500		131,051

Caiman and Collingwood.

It was stated by Sir Nathaniel Barnaby, in his evidence before Lord Ravensworth's Committee, that when the original design for the Collingwood was commenced, it was intended to build for the British Navy a few vessels of a class corresponding with the four French ships of the Caiman type. On a displacement of 7230 tons, the Caimans carry a narrow belt of armour, varying in thickness from 20 to 14 inches. Their heavy armament consists of two 75-ton guns in towers *en barbette*. When it became necessary to satisfy the more exacting requirements of the British Navy in respect to seaworthiness, coal-endurance, and supply of ammunition, the constructors found themselves compelled to propose a design of 2000 tons in excess of the displacement of the Caiman.

Renown and Sans Pareil.

The ironclads proposed to be laid down, and described to Parliament in December, 1884, were styled new "Conquerors," because the type was derived from the single-turreted ships of that name. In the new ships, however, the displacement was increased from 6200 to 10,470 tons; the weight of armour from 900 to 2000 tons; the indicated horse-power from 6000 to 8500; the armament from two 43-ton to two 110-ton guns, and the coal stowage from 650 to 1,200 tons. The minor armament of 6-inch and 6-pounder quick-firing guns and Nordenfelts was more than doubled.

Cruisers.

Descending from ironclads to cruisers, a similar development was shown. The first design originated under Lord Northbrook's Board

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was that approved for the armoured cruisers Warspite and Impérieuse. In these ships it was intended to combine fighting qualities at least equal to those of the second-class ironclads of foreign navies with a speed of 16 knots. The displacement of the latest French second-class ironclads was 5869 tons; that of the Warspite, 7390 tons. In the belted cruisers designed, like the Leander, for the protection of commerce, the dimensions were increased from 3750 to 5000 tons, and the speed from 16 to 18 knots. The armament was strengthened by the addition of two 22-ton guns.

Armaments and speed.

Turning from dimensions to the more important features of fighting efficiency, all the more recent first-class ships were armed with breech-loading guns, and all had a designed speed of at least 16 knots as compared with the 14 knots of the Inflexible. The Conqueror type has a speed only a fraction below 16 knots.

The shipbuilding for the Navy of a previous period may have merited such severe criticism as that recently pronounced by Admiral Hornby at Portsmouth, when he spoke as follows: "We have ships without speed, guns without range, and boilers with only a few months' life in them. This is called economy, but it is really only not expending money, closing the purse strings, and keeping our fleet in such a state of inefficiency and unpreparedness as to render it comparatively useless should we at any time become involved in war with a Maritime Power." For the recent additions to the Navy we have nothing to fear from a comparison with contemporary building abroad, whether in speed or armament. The armoured ships laid down by Lord Northbrook's Board were of five types, represented by the Impérieuse, the Admiral class, the Hero, an exact repetition of the Conqueror, the Sans Pareil and Renown, which may be described as improved Conquerors, and the five belted cruisers. The principal dimensions of the Impérieuse are, length, 315 ft.; breadth, 62 ft.; tonnage, 7390. The speed at the measured mile is 17 knots. The Impérieuse carries four 18-ton breech-loading guns and a powerful minor armament. As compared with the Admiral class, the disposition of the belt and deck armour is similar, but the thickness is reduced from 18 to 10 inches. The belt in each case extends along more than two-fifths of the length. It protects the machinery and the magazines, and assists in securing the stability and the buoyancy. The armour of the barbette towers, in which the heavy guns are mounted, protects the loading machinery; and the guns' crews are screened from horizontal fire.

Impérieuse.

Admiral class.

The type of ironclad represented by the Impérieuse was the first new design originated under Lord Northbrook's Administration. The

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designs for the Admiral class were considerably advanced under the Administration of Mr. W. H. Smith. The turret ships Colossus and Edinburgh, and the barbette ships of the Admiral class, are built on nearly the same lines. These ships have an extreme breadth of 68 ft., as compared with 66 ft. in the Ajax. The length has been extended from 280 to 325 ft. With this more favourable proportion of length to breadth an additional speed of nearly two knots has been obtained without increasing the horse-power.

In the Admiral class an important change was introduced in the disposition of the armour. In the Colossus it forms the wall of the citadel. In the Collingwood it is taken away from the central citadel, and formed into separate fixed barbette towers. The towers are placed 140 ft. apart, and the guns 22 ft. above the water. The enclosed turrets of the Colossus are 80 ft. apart, and the guns are 12 ft. above the water. The minor armament forms an important and novel feature in the Admiral class. Between the barbettes, and above the true upper deck, is a large unarmoured battery, protected by 1-inch steel plating from the fire of machine guns, and containing six 6-inch breech-loading guns, fought at ports 14 ft. above the water. The battery is protected from a raking fire by winged bulkheads plated with 6 in. of steel-faced armour. In this respect the Collingwood's battery resembles the batteries of the Nelson, Northampton, and Shannon. The crew will be berthed in the upper battery, and will have accommodation infinitely superior to that of any turret ship. The deck above the upper battery affords ample space for the stowage of boats and for working the ship. The advantages presented by the Admiral type will be best appreciated whenever squadrons are compelled to keep the seas for extended periods. Ships with a low free-board are too much under water to be reasonably habitable. This disadvantage was brought prominently into view during the cruise of the Evolutionary Squadron. Steaming to the westward from Berehaven on a summer's night the fore-deck of the Devastation was swept by sheets of foam, while the upper decks of the broad-side ships were towering high above the waves. That a turret-ship of low freeboard is the most powerful type for battle will not be disputed, but life on board in a long cruise would be wretched.

In the Admiral class, as in the Inflexible, Ajax, Agamemnon, Colossus, Edinburgh, and new armoured cruisers, the belt armour stops short of the ends, and the protection of vitals is continued by an under-water deck. The length of the belt is extended from 123 ft., as in the Colossus, to 140 ft.

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The weights of armour, including deck armour, are:—

	Tons.
Ajax	2,223
Colossus	2,364
Conqueror	1,720
Armoured Cruiser	1,446
Collingwood	2,548

The heavy guns of the Admiral class are mounted *en barbette*. Various plans were proposed for enclosed turrets. The additional expense involved ranged from £40,000 to £100,000, and considerable delay would have resulted from any material alterations. The improvements anticipated did not appear to be sufficient to justify the loss of time and the heavy outlay.

The introduction of barbettes into our Navy, when first proposed, led to much discussion. It was considered that the additional weight required for the armoured citadel, which is indispensable for the protection of the base of the turret, could be better used in increasing the speed and the coal endurance, and in mounting a greater number of heavy and auxiliary guns. Turret-guns cannot be mounted as high above the water as guns *en barbette*.

Conqueror. The ironclads of earlier design will not require detailed description. The speed of 15½ knots attained in the trials of the Conqueror was most satisfactory. The Conqueror is a valuable addition to the Navy, being well armed and armoured, an effective and handy ram, and a thorough sea-going ship. With their superior manœuvring qualities, such vessels must be formidable in battle, and they will always be required for the general duties of the Fleet. The Hero, a repetition of the Conqueror, was laid down in 1883, and has recently been launched. The rapid progress of this vessel was highly creditable to Mr. Warren and the professional officers and workmen at Chatham Yard.

Sans Pareil and Renown. In April, 1885, two large ironclads, which we have described as of the Conqueror type, were put out to contract. The Sans Pareil and Renown will have a displacement of just over 10,000 tons. The armour will have a thickness of 18 in., and the framing behind the armour will be stronger than any hitherto employed. They will carry in a single turret two 110-ton guns, the most powerful yet manufactured. An 18-ton gun will be mounted right aft. Twelve 4-ton guns will be carried in the battery protected with armour proof, not only against all machine guns, but also against the new 6-pounder shell guns. The estimated speed is 16·75 knots.

Belted cruisers. The belted cruisers formed the most novel and important feature in the extended programme of building commenced under Lord Northbrook's Board. They were determined to seize the opportunity

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which circumstances had afforded them of producing designs of an original character, worthy of the national reputation. Such has ever been the aim of the British Admiralty, and they have generally been successful. Perhaps the most valuable testimony to that success which could be produced is the report of the chief engineer of the United States Navy, Lieutenant King, who was sent to Europe to examine into the condition of the various navies.

"True to their national instinct of systematic classification, the French had laid down simultaneously many ships of one design. The English Admiralty have pursued a different and a wiser course. Instead of spending their great resources on the construction of ships which were mere fac-similes of each other, they have with rare exceptions in successive designs made onward steps in offensive and defensive power."

The belted cruiser is a ship of about 5000 tons displacement, and 3000 tons weight of hull, including 1000 tons of armour. The water-line being protected by a 10-in. armour belt and a thick deck from end to end, and the conning tower being strongly armoured, the belted cruiser may fairly be reckoned with many ironclads in foreign navies. The guns will be two of 22 tons and twelve 6-inch of 4 tons, with machine guns. The coal supply will be sufficient for 2000 knots at full speed and 8000 knots at 10 knots. In addition to their armament of guns the belted cruisers will be fitted with effective means for the discharge of torpedoes. In speed we may claim for our belted cruisers a marked superiority over any armoured ships afloat or building. In the first instance a speed was announced of 17 knots. The latest estimate is 18 knots. So far as we know the only vessels of superior speed now building for any Navy are three now building for Italy and two for the Japanese. All these vessels are without protection, and with their smaller displacement they could not hold their own in a long run at sea against the belted cruisers. Five of this type were ordered by contract in April, 1885. Two more vessels of the same type were laid down by the Conservative Board, one at Pembroke and another at Chatham.

Nile and Trafalgar.

The new type of battle-ship laid down under the late able Conservative Administration is represented by the Nile now building at Pembroke, and the Trafalgar at Portsmouth. They were described in Parliament by Mr. Hibbert as follows:—"These two vessels are the largest armourclads yet constructed for the English Navy, and they surpass in displacement all foreign armourclads except four vessels now being constructed for the Italian Navy. Their dimensions are—length, 345 ft.; breadth, 73 ft.; displacement, 11,940 tons;

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indicated horse-power, 12,000. The estimated speed will be about 16½ knots. There will be an armoured citadel 193 ft. long in the central position of the ship, and at each end a turret. Each turret will contain two 68-ton breech-loading guns. Between the turrets and above the citadel is a central box-battery lightly armoured, which will contain eight 5-in. breech-loading guns, and on the spar deck covering this battery the boats will be stowed, and a number of quick firing machine guns mounted. The turret guns will be loaded and worked by hydraulic power, and revolve in the same way. Each ship will have a powerful torpedo armament, and will also be fitted for ramming. They will be capable of carrying 1200 tons of coal in the bunkers, and will have no rig. The armour-belt at the water-line extends to about 230 ft. amidships, and before and abaft the belt a strong steel deck, 3 in. thick, protects the vitals. The armour on the belt will be 20 in., on the sides of the citadel 16 in. to 18 in., and on the turret 18 in. The inner armour, about 2 in., is also worked behind the teak backing. Now we come to the cost, which is very large indeed, and I am almost afraid to mention it. But when I look at what other ships have cost which are not so powerful, and which can never be so protected as these vessels, I do not know that the sum is very excessive. The cost of each vessel will, with the guns, be not less than £919,134, which is approaching a million of money. The hull will cost £686,000, the propelling machinery £97,000, and the gun mountings £79,794. The guns will cost £56,340. Hon. Members may think that a large sum, but we have expended these large sums previously on other vessels. The Inflexible cost £809,600; the Benbow, which is a contract ship, is to cost £789,162; and the Renown, built by Sir W. Armstrong, which is the same size as the Benbow, £789,995. If we are to be stronger than any other Power, we must make up our minds to go in for this large expenditure. I may safely say that these two large ironclads will probably be the last ironclads of this type that will ever be built in this or any other country. These two large ships, which were first suggested by Lord Northbrook, and commenced by the noble lord opposite, will be equal, I think superior, to any ship of the same character in the French Navy."

These ships will be armed with 67-ton guns. To carry the same number of guns as, but 30 tons heavier than, the Dreadnought, and provide for other improvements, it has been necessary to add 23 ft. 9 in. to the length, 5 ft. 3 in. to the beam, and 1110 tons to the displacement. The side armour will be raised high enough to protect eight 6-in. guns.

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CHAPTER VIII.

Belts and Central Citadels.

History of recent armoured construction.

In connection with ship-building, a difficult question has recently been raised by Sir Edward Reed. For the defence of the water-line he asked for a greater length of armoured belt. Sir Nathaniel Barnaby preferred a system of protection by cellular subdivision.

The history of this question may be briefly told. When Lord Northbrook came into office, three types of large armoured ships were in progress. The central citadel type, represented by the Edinburgh and Colossus, the Admiral class, represented by the Collingwood, and the Conqueror, which may be called a second-class ironclad. As both the central citadel type represented in the Colossus, and the six ships of the Admiral type have in turn been condemned, it may be convenient to explain the origin of these types. For this purpose it will be necessary to go back to the rather remote period when the ships built for the Navy commanded unanimous approval. Through all the uncertainties and vicissitudes of controversial discussion on ship-building, we have one type universally approved by naval officers. That ship is the Dreadnought. The design was the result of the combined labours of Sir Edward Reed and his successors. Confining ourselves to the feature in question in the recent controversy—the system of protection—we find in the Dreadnought a continuous belt, and the whole side of the ship in wake of the central citadel amidships protected with armour from the belt to the upper deck.

Dreadnought.

The armour of the Dreadnought varies in thickness from 14 inches to only 8 inches. Important parts of the water-line are covered with only 9-inch armour. The citadel is protected with 11-inch plates. Our constructors were entirely satisfied with the Dreadnought, but when demands were pressed for armaments increased from the 38-ton guns of the earlier ships to the 80-ton guns of the Inflexible, and for a corresponding thickness of armour, it became necessary to remove the armour from the non-vital parts of the ship, and to concentrate on the vitals. This gave us the Inflexible. In that ship the central

Inflexible.

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citadel was considerably shortened, and the belt reduced to the same length as the citadel, the extremities being protected by a raft body instead of armour, on the plan shadowed forth by the Committee on designs.

When the central citadel type was first introduced in the Inflexible it was severely criticised. The design was referred to a Committee, and what was the result of that inquiry? The Committee did not report that the armoured citadel was indestructible. They said that in their opinion the unprotected ends were as well able as the armoured citadel to bear the part assigned to them, and that a just balance had been maintained in the design. The citadel system having been approved in the case of the Inflexible, and in Ajax and Agamemnon then building, what course did the Board of Admiralty then pursue? They laid down the Colossus and the Edinburgh, central citadel ships of the type represented by the Inflexible.

Collingwood.

Having so recently gone through the ordeal of the inquiry on the Inflexible, it may be presumed that the Admiralty would not lightly have sanctioned a new departure in ironclad building. They felt themselves compelled, however, by the inexorable demands for thicker armour and higher speed, to accept once more a change of type, and the Collingwood, the first of the Admiral class, was laid down by the Board presided over by Mr. W. H. Smith.

The modifications of type introduced in this vessel had for their objects, first, the further development of the principle of duplication; secondly, a more effective position for the guns; thirdly, improved sea-going qualities; and fourthly, increased speed.

The principle of duplication had already found its practical expression in the twin screws, the division of the engine-room and boilers by longitudinal bulkheads, the two turrets, and the two guns in each turret. This principle was carried still further in the Collingwood by substituting for the central citadel two separate fixed barbette towers. As it has already been stated, the towers were placed 140 ft. apart, and the guns 22 ft. above the water. The enclosed turrets of the Colossus, the central citadel ship which immediately preceded the Collingwood, are 80 ft. apart. The base of the turrets is protected by one central citadel, and the guns are 12 ft. above the water. Naval officers will appreciate the advantage of the increased height at which the guns of the Collingwood are carried at sea. The hydraulic loading machinery of each turret is completely independent of the other. When the whole of this delicate machinery was contained in one central citadel, penetration by a single shell might have been fatal to the working of both turrets.

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This might occur in the Inflexible. It cannot happen in the Collingwood. The belts might have been extended by reducing the armour to thicknesses easily penetrable by guns of moderate calibre. The armoured deck and compartments were regarded as more effective than a thinly plated belt.

Criticisms on Collingwood.

It may be urged that since the Committee on the Inflexible reported, a change has taken place in the armament of ships, and that the light shell guns, which would inflict the most serious destruction on the unarmoured vessels, are now carried in greater numbers. It is obviously highly improbable that the fire of an enemy would be directed at the water-line, while the men at his guns were exposed to a hail of fire from the light guns of their adversary.

It has been objected that the belts of the Admiral class are not carried to a sufficient height above the water-line. They are carried to a height of 2 ft. 6 in. above the load-line, and to a depth of 5 ft. below it. The height of the belt above water is somewhat greater in the French ships.

It has also been objected that too much reliance is placed upon cellular compartments filled with coals. Many experiments have been tried, and the results show that wing bulkheads with coal between absorb the effect of an explosion, and afford effective protection. At Shoeburyness it has been experimentally proved that loose coal has an extraordinary value for absorbing and neutralising the explosive effect of shells.

Comparison with French designs.

In the latest French designs produced by Naval architects of the highest ability, we find, on comparing their ships with our own, that with ships of equal dimensions, every advantage they obtain over ourselves in one element of fighting efficiency, involves the sacrifice of some other element to which our Naval advisers attach a higher importance. In our barbettes and turrets a great weight of armour is employed, to give protection to the guns' crews while loading. The heavy pieces of the French ships are exposed to the withering fire of quick-firing guns.

Our batteries are protected from a raking fire by transverse heavily-armoured bulkheads. The batteries in the foreign ships have no similar protection. They have nothing to prevent a raking shot from penetrating to the engine-room. In other navies, a greater proportion of displacement, or in other words, a greater proportion of the weight of the ship may be allowed to armour, and less to machinery, coal, armament, and ammunition. We were not willing to relinquish an advantage of speed of 16½ knots as against 15 knots, a large superiority in coal supply, a more powerful armament, and a

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General observations.

more ample supply of ammunition for the sake of more protection by armour. If no sacrifice is admissible in the points in which we have attained a superiority, and we wish to keep our ships within reasonable limits as to dimensions, one of two things must be accepted. If, as in the French ships, armour is accumulated on the belt, it is taken from the battery, and the guns, crews, and the hydraulic machinery are left unprotected. If, on the other hand, heavy armour is retained for the protection of the gun, as in the case of the Italia and the Lepanto, the water-line, notwithstanding that the dimensions have been advanced in these ships to nearly 14,000 tons, throughout its length is protected by arrangements identical in their character with those on which we rely to protect the extremities alone of the Admiral class of 10,000 tons.

In considering the difficult question of the best mode of protecting ships by armour, the decision must chiefly depend on the guns to which they may be opposed. Thin armour, widely spread, would be the best protection against light guns. Against heavy guns thin armour would be useless.

The most practical rule for our guidance in considering the distribution of armour is that recommended by the Committee on Designs: "We must watch carefully the shipbuilding of other nations, and modify our system of protection to meet the changes which are taking place in the armament of ships." If it were possible, without prejudice to other qualities, to increase the weight of armour in our ships, it is a grave question where that additional armour should be carried. In war, something must be left to chance; and a direct hit on the water-line is rare in the stern experience of battle. In all the hard-fought actions at close quarters in the great wars, ships were rarely sunk by the fire of the enemy. While, however, the ships were seldom injured fatally at the water-line, the carnage was terrible among the men, crowded together at quarters.

The more this subject is considered, the more strongly must the conviction be established, that it is impossible to produce a perfect ship, with which a competent critic would have no fault to find. The most successful design is at best a compromise.

Numerous attempts have been made to secure complete protection by armour in ships of moderate dimensions, but all these attempts have led to a departure from forms which experience has proved to be the best. The Russians found their Popofkas unmanageable, and the American Monitors were too deficient in free-board to be habitable at sea. High speed, great coal endurance, heavy armament, protection of men, protection of magazines and machinery, buoyancy

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and stability, armour not penetrable by the heaviest guns, defence against torpedoes, absolute seaworthiness, ready obedience to the helm, and a moderate draught of water, are all qualities most desirable in a ship of war. The mere enumeration is sufficient to prove the impossibility of combining all that we want in any single type. A sketch-design was once prepared at the Admiralty to embrace all the more important conditions which have been demanded by various critics, and the estimated cost of this vessel was £1,800,000.

While the arguments in favour of the design adopted for the Collingwood, and the five other ships of the Admiral class, are powerful and cogent, the compiler entirely approves the decision of the Conservative Board to give longer belts to the Nile and Trafalgar.

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CHAPTER IX.

UNARMOURED VESSELS.

GENERAL OBSERVATIONS.

Increase in unarmoured building, 1885–86.

HAVING accelerated greatly the armoured construction, Lord Northbrook's Board, in the earlier years of their Administration, did not feel justified in pressing for a similar increase of expenditure on the unarmoured ships. Unarmoured construction had for many years been carried on for the British Navy in proportions greatly in excess of the unarmoured building for the French Navy. In the ten years, 1872–81, in the class of unarmoured cruisers, 90,000 tons had been launched for the British Navy, against 34,081 tons for the French. In the enlarged programme of building for 1885–6, a great development was exhibited in the construction of unarmoured ships. There were two objects principally in view; firstly, to reinforce the Navy in ships for the protection of commerce; secondly, to provide for the fleet a powerful flotilla of sea-going torpedo vessels. The expenditure proposed for unarmoured construction in 1885–6 was advanced to £1,431,000, or nearly double the average of the eight preceding years.

It has been admitted that hesitation was felt in the earlier years of Lord Northbrook's Administration to make increased demands on the liberality of Parliament for accelerating the construction of unarmoured vessels. The French were concentrating their main efforts on armoured building, and for the defence of British commerce the Admiralty had made arrangements for organising a numerous reserve of merchant cruisers. But the desirability of raising the strength of the Navy in cruisers suitable for the protection of commerce needs no demonstration. The case was stated by the compiler in Parliament as follows:—

"It is not easy to fix a standard of strength at which our battleships should be maintained; but when we come to deal with the question of what number of ships may be necessary for the protection of our world-wide commerce, the difficulty is infinitely greater. A

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means of attack upon our commerce may be improvised to an extent which it is quite impracticable to measure, by the conversion of merchant-steamers into cruisers, armed with a few light guns. On the other hand, the risks exposed to such an attack are of enormous magnitude, and, indeed, of vital importance to this country. It has been computed that the value of British shipping and merchandise yearly placed upon the ocean is not less than £900,000,000 sterling, and that we have at all times afloat on the seas property in ships and merchandise of the value of not less than £144,000,000."

British unarmoured vessels deficient in speed.

Commencing their task under the conviction that in point of expenditure they must be content to work within the limits accepted by their predecessors, the attention of the Board of Admiralty was concentrated on improvement of type. In cruisers high qualities of speed and coal endurance are indispensable. In these important points the British Navy was sensibly inferior to the French. In 1880, of ships capable of steaming 14 knots, we possessed only eleven, the French had twenty-five.

Comparison with France.

The names, dates of launching, displacement and speed of the later unarmoured ships of France and England are given in the list below:—

French.

Name.	Date of Launching.	Displacement.	Speed.
		Tons.	Knots.
Duquesne	1876	5,800	16.90
Tourville	1876	5,600	16.89
D'Estaing	1879	2,400	15·31
Duguay Trouin	1877	3,300	15·90
Du-Petit-Thouars	1874	2,000	15·07
Lapérouse	1877	2,400	14·73
Seignelay	1874	1,900	15
Villars	1879	2,400	14·25
Eclaireur	1877	1,830	15
Rigault de Genouilly	1876	1,710	14·49

For list of British unarmoured cruisers of corresponding dimensions, see next page.

The cause of the deficiency in speed of the British ships is clearly apparent, when we compare their principal dimensions with those of the French designs. For our ships, handiness and stability under sail had been insisted upon, and with a view to comply with these conditions the beam was excessive in proportion to the length. The French models were designed more particularly with reference to their steaming qualities, and finer lines had been adopted.

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British.

Name.	Date of Launching.	Displacement.	Speed.
		Tons.	Knots.
Carysfort	1878	2,380	12·96
Champion	1878	2,380	13
Cleopatra	1878	2,380	13
Comus	1878	2,380	12·93
Conquest	1878	2,380	13
Cordelia	1881	2,380	13
Curaçoa	1878	2,380	13
Diamond	1874	1,970	12·56
Emerald	1876	2,120	13.20
Garnet	1877	2,120	13
Opal	1875	2,120	13·13
Ruby	1876	2,120	12·28
Sapphire	1874	1,970	13·58
Tourmaline	1875	2,120	12·62
Turquoise	1876	2,120	12·32

Mercury and Iris.

A new and better policy of unarmoured construction was inaugurated by the Admiralty of 1874–80. They began by building the two despatch vessels, Mercury and Iris, with a speed not approached up to that date in any naval service. In the Mercury and the Iris the speed was obtained by an enormous development of horse-power. The defensive arrangements were but little superior to those of a cruiser from the Mercantile Marine. The cost per ton was equal to that of the most powerful ironclad, while the fighting power was inconsiderable. As a fighting ship, the Mercury would be chiefly valuable as a torpedo-boat catcher. It was in this service that the ship was employed in the Experimental Squadron under Admiral Hornby.

The Polyphemus was a bold experiment in the class of ocean-going torpedo boats. The Leander was the forerunner of a new and valuable type which we owe to the same Administration. Lord Northbrook's Board were deeply impressed with the necessity for developing the construction of vessels of the Leander and Polyphemus types. They cut down top hamper and took advantage of the recent advance in gun construction to reduce the weight, while adding greatly to the efficiency of armaments. The models approved for the new ships were more favourable to high speed. The ship-building policy of Lord Northbrook's Board in relation to unarmoured vessels may be traced in the enumeration of the ships laid down.

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Unarmoured Ships Laid Down, 1874–85.

Classification according to Speed.

Year.	Steam Cruisers, 2nd Class.	Corvettes.	Despatch Vessels.	Sloops.	Gun Vessels.	Gun Boats.	Torpedo Vessels.	Total Number and Speed of Vessels laid down.	
								16 Knots and over.	15 Knots and over.
1874 (from 1st April)	..	4	..	2	..	3	..	..	..
1875	..	1	1	3	2	..	..	1	..
1876	..	6	1	3	..	18	..	1	..
1877	..	..	..	2	..	..	..	..	..
1878	..	1	..	4	2	9	1	1	..
1879	..	2	..	2	3	5	..	..	..
1880	3	..	..	3	..	3	..	3	..
1881	1	2	..	3	2	3	..	1	2
1882	..	..	..	..	1	..	..	..	..
1883	1	..	..	1	4	..	..	1	..
1884	2	..	2	..	..	2	1	7	..
1885	..	..	..	..	..	..	7 (Archers)	7	..

In addition to the above, fifty-four first-class sea-going torpedo boats, length 125 ft. and speed 19 knots, were laid down in 1885, and six others of smaller dimensions were built or purchased.

Passing from numbers to type, the first four ships of a large class laid down for the protection of commerce under Lord Northbrook's Board were of the Leander type. The Leanders have a displacement of 3750 tons. Their speed is 17 knots. Their armament includes eight Nordenfelts, four Gardners, and ten 6-inch guns. Their coal supply is 1016 tons. These ships were followed by the four ships of the Mersey type, with an estimated speed of 17 knots, which will probably be exceeded. Leander.

The following detailed description of one of the ships of the Mersey class is taken from the *Army and Navy Gazette* of October 3rd, 1885 :— Mersey.

"Another important addition has been made to the British Navy by the launch at Chatham Dockyard of the Severn, 'a fast twin-screw protected steel corvette' of the same type as the Mersey, launched at the same dockyard about five months ago, the official trials of which vessel last week are said to have given entire satisfaction, the uniform speed of close upon 18 knots being realised. The Severn, which has been built in a comparatively short time, is intended to be employed as a swift cruiser for independent service in distant seas, and is

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Unarmoured Ships Laid Down, 1880–85.

Classification according to Type.

Class.	Number laid down. 1880.	1881.	1882.	1883.	1884.	1885.	Total Number laid down, 1880–85.	Displacement.	Length.	Breadth.	Draft.	Speed.	Days Steaming at 10 Knots.	Present Armament.
								Tons.	ft. in.	ft. in.	ft. in. Mean.	Knots.		Guns.
Leander	3	1	..	..	..	..	4	3,750	300 0	46 0	19 0 (a)	17 (a) (e)	44	10 6″ 89 cwt. B.L.
Mersey	..	..	..	1	2	1	4	3,550	300 0	46 6	18 0 (a)	18 (a) (e)	33	2 8″ 12 ton B.L. 10 6″ 89 cwt. B.L.
Calliope	..	2	..	..	..	..	2	2,770	235 0	44 6	18 8 (a)	15 (e)	16·	4 6″ 89 cwt. B.L. 12 5″ 36 cwt. B.L.
Archer	..	..	..	..	..	7	7	1,030	225 0	36 0	13 6	17·0 (a) (e)	..	6 6″ 81 cwt. B.L.
Scout	..	..	..	..	1	1	2	1,430	220 0	34 0	13 6	17·0 (a) (e)	29	4 5″ 36 cwt. B.L. 6 6″ 81 cwt. B.L.
Satellite	3	3	..	1	..	..	7	1,420	200 0	38 0	14 3 (a)	13·10 (a) (e)	41	3 ships 8 6″ 81 cwt. B.L. 2 ships 14 5″ 36 cwt. B.L. 2 ships 2 6″ 81 cwt. B.L., 10 5″ 36 cwt. B.L.
Alacrity	..	..	..	..	2	..	2	1,400	250 0	32 6	13 0	17 (e)	25	4 5″ 36 cwt. B.L.
Swallow	..	..	..	..	1	..	1	1,040	195 0	28 0	11 6	13.50 (e)	..	8 5″ 36 cwt. B.L.
Acorn	..	..	1	4	..	1	6	970	167 0	32 0	12 9	11 (a)	8·1	4 ships 8 5″ 36 cwt. B.L. 2 ships 6 5″ 36 cwt. B.L.
Dolphin	..	2	..	..	..	..	2	925	157 0	32 0	12 9 (a)	10·50	7·	2 6″ 81 cwt. B.L. 2 5″ 36 cwt. B.L.
Curlew	..	..	..	..	2	..	2	790	195 0	28 0	10 6	15 (e)	..	1 6″ 81 cwt. B.L. 3 5″ 36 cwt. B.L.
Albacore	..	3	..	..	..	..	3	560	135 0	26 0	10 4½ (a)	11	7·	2 5″ 36 cwt. B.L. 2 4″ 22 cwt. B.L.
Starling	3	..	..	..	..	..	3	465	125 0	23 6	9 10	9·50	..	2 64-pr. M.L. 2 20-pr. B.L.
							45							

(a) Estimated.
(b) Average estimated cost (hull and machinery only).
(c) Average actual cost of the six ships of the class laid down in 1880 and 1881.
(d) Contract price of hull and machinery.
(e) With forced draught.

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unprovided with armour, as she will have to rely on her offensive powers and her high speed. In order to combine strength and lightness, steel has been used in her construction wherever practicable, this arrangement adding stiffness and rigidity to the hull. The principal features of the structural portion of the new vessel are the steel hexagonal-shaped hull, steel deck, ample coal-bunkers, the fineness of her lines fore and aft, and the clear run of the hull abaft. The plating of the horizontal section of the steel deck of the 'protected' hull is two inches thick, the slopes being three inches in thickness, with a further protection in the form of spacious coal-bunkers above and around. The armament of the Severn consists of a 6-in. breech-loading stern chaser, ten 6-in. and two pivoted 8-in. breech-loaders, one 9-pounder boat and field gun, one 7-pounder ditto, six 1-in. Nordenfelts, and two 45-in. Gardners, while ports above and below the water-line have been provided for discharging Whitehead torpedoes. The semi-circular 'swallow nests' on the port and starboard sides—two on each side—are for working the machine guns *en barbette* on the upper deck. These are arranged forward so as to allow guns to be trained 4° across the bow and to an angle of 60° abaft, giving a lateral range of 154°, while from the same points they may be fired with a depression of 7° or an elevation of 20°. With the view of enabling the vessel to attain a maximum rate of speed triple air-tight doors have been provided in the 'wings' to prevent any interference with the 'forced draught' system of increasing the generation of steam. The engines are in duplicate sets, one on each side of the ship; they are of the direct-acting horizontal compound class, of 6000 indicated horse-power. Accommodation has been made for the stowage of 500 tons of coal. The ship is also furnished with a ram. The officers' cabins, men's accommodation, pumps, &c., are on the main deck, tangential plates being furnished to the lower deck opening on this deck; the bulwarks are higher than usual, and, like the sides of the vessel, are of half-inch plates. The following are the principal dimensions of the ship:—Length between the perpendiculars, 300 ft.; breadth extreme, 46 ft.; draught of water—forward 16 ft., aft 19 ft. 6 in., mean 17 ft. 9 in. The load displacement is 3600 tons, the estimated speed is 17½ knots per hour, and the crew will consist of 300 officers and men. The building of the vessel was commenced on July 9, 1883."

In the smaller vessels, the corvettes and sloops, similar improvements were introduced. The speed was advanced from the 10 knots previously accepted to an average of not less than 13 knots. As an example of the improvements recently secured in the gun-vessel

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class, the following comparative statement may not be without interest:—

	Mistletoe.	New Mistletoe.
Length	135	165
Breadth	26	29
Area of plain sail	4,700	5,320
Indicated horse-power	770	1,000
Speed	11	13
Coal endurance—		
At most economical speed	3,800	7,600
At full speed	1,250	2,590
Armament	2·5 in. Breech-loading guns. 2·4 in. ditto. 2 Gardners	6·4 in. Breech-loading guns. 2 Nordenfelts. 2 Gardners.
Cost	£30,960	£33,000

Heroine.

Ships capable of cruising under sail will always be required in the Navy, both for the training of seamen, for the police of the seas, and for a certain portion of the duties which the Navy will be required to undertake in war. For ocean cruising, and when operating at a distance from a reliable source of coal supply, an ample spread of canvas is essential. In this quality the fast steamers are necessarily deficient. For the police of the seas Lord Northbrook's Board accepted the Heroine type, of which seven were laid down. The displacement of these vessels is 1,420 tons. The speed under steam on the measured mile equals that of the large "C" class, while the cost is £72,000 in the Heroine against £118,000 in the "C" class.

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CHAPTER X.

The Torpedo Flotilla.

In the criticisms of the naval administration of Lord Northbrook's Board, the neglect of the *torpedo* was a prominent topic. The reasons for hesitation in the expenditure of large sums on the torpedo were not far to seek. The Admiralty had made a great advance in the extent of armoured construction. They were doing much to improve the unarmoured fleet. Before undertaking repetitions of the Polyphemus, it was essential to obtain a solution of many problems which were not advanced beyond the experimental stage. The necessity for rapid progress in building more boats was not regarded as urgent. In a period of transition, the Admiralty could not put out of view the varied resources at the disposal of a British Administration for the rapid construction of torpedo boats in case of emergency. With the most lavish expenditure ironclads could not be improvised. The multiplication of torpedo boats elsewhere did not necessarily require a corresponding construction for ourselves. Coast-service torpedo boats are the arm of the feeble; they are efficient chiefly for defensive purposes. In the Gulf of Finland they are a good defence for the Russian ports, but they could not be sent across the sea or threaten the coasts or the commerce of this country.

When the Admiralty were enabled to propose a large increase of construction for 1885–6, the programme was criticised on the ground that more attention should have been given to torpedo boats. The Admiralty were of opinion that sea-going torpedo cruisers were, in the circumstances with which they had to deal, a more urgent necessity. Their programme included a repetition of the Polyphemus, which, on further consideration, has been for the present abandoned. No less than seven vessels of the Scout or Archer class were to be laid down; two having already been commenced in 1884. To this list we may add the two despatch vessels, the Alacrity and the Surprise, specially designed for service as torpedo cruisers, and the two steel gun and torpedo vessels, the Curlew and the Landrail,

Torpedo cruisers.

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Grasshopper class.

which had been constructed at Devonport. The work commenced under Lord Northbrook was carried forward, as far as the resources would admit, by the Conservative Board. They laid down four vessels of the Grasshopper class—450 tons and 19 knots. The Grasshopper class will supply to the Navy a type intermediate between the Archer class and the coast-service boats. Such a type was urgently needed to act in combination with our armoured squadrons. The cruise undertaken by the torpedo boats attached to Admiral Hornby's squadron, and the more recent voyage of the four torpedo boats from Malta and Suda Bay in the depth of winter were not unattended with risk. The torpedo boats of the new class are doubtless capable of contending with heavy weather, but it is idle to suppose that vessels of from 50 to 60 tons can keep at sea for extended periods without reducing the crew to a state of exhaustion. If Lord Nelson found that the fag from service in a brig was very great when constantly at sea, we may rest assured that life in a torpedo boat would be intolerable. The crews of six out of the seven boats recently sent round from the north coast of France to Toulon arrived at their destination in an exhausted condition.

Torpedo boats.

In addition to the flotilla of torpedo cruisers, fifty-four first-class sea-going torpedo boats, 125 ft. long and 19 knots' speed, were laid down in 1885, as already stated, and will be completed in the present financial year. We may regret the delay in taking the work in hand, but it will be admitted that we have made the commencement of a most powerful and efficient sea-going torpedo flotilla.

Having explained the general policy of the Admiralty, we may proceed to give detailed descriptions of the principal types laid down.

The Scout.

The Scout class was first introduced into the building programme in 1884. This vessel is in many respects an enlarged torpedo boat, intended to keep the sea in all weathers, and to guard our commercial marine. The following description of the hull and machinery was published in *Engineering* on July 31st, 1885:—

"Built of steel throughout, the Scout is a vessel measuring 220 ft. in length, by 34 ft. beam, and 19 ft. depth of hold, with a displacement of 1,430 tons. In designing the Scout, and other six somewhat larger vessels of the same class, which Messrs. Thomson also have in course of construction, the officers of the Admiralty had in view as their special object the production of small vessels capable of attaining a high rate of speed, and able to keep the seas for a considerable length of time. Following up the improvements made in the Iris, and still further developed in the Leander, they have ren-

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dered it possible to obtain a speed of 16½ knots per hour, which is the estimated speed of the Scout, even with a much smaller horse-power of engines than was formerly thought necessary. Forced draught has been introduced, and successfully developed and used in vessels recently built for the Royal Navy, and this innovation has rendered it possible to produce considerably more horse-power for a given weight than was formerly practicable. This latter advantage is so great that the machinery of the Scout only weighs 2 cwt. per indicated horse-power, while in the case of the vessels of the Comus class, which were built only some six years ago, the machinery weighed from 3¼ cwt. to 3½ cwt. per indicated horse-power. With the improvements in the form of the ship and the adoption of forced draught, it has been rendered possible to produce the Scout, a vessel of 220 ft. in length, and 1430 tons displacement, capable of travelling at the rate of 16½ knots per hour, and of carrying coals sufficient for seven days' full-speed steaming. She has been fitted while on the stocks with twin-screw engines of 3200 indicated horse-power placed in one engine-room, and four boilers of the Navy type placed in two separate rooms. There is a protective deck of steel ⅜ inches in thickness. It extends 100 ft. amidships, covering the engine and boiler rooms, further protection being obtained on either side by blocks of coal reaching to a thickness of from 5 ft. to 7 ft., and placed below the water-line, fore and aft. Where there is no protective deck covering, the vessel is very minutely subdivided, so that the chances of disablement by flooding are not so great in these parts. As regards the armament, there are two torpedo tubes in the bow and one in the stern, all capable of firing in a line with the keel; there are likewise four on each side of the ship, on the upper deck, thus making eleven tubes in all. There are also to be four 5-in. guns, and eight machine-guns. The magazines for the ammunition required by this small armament are comparatively simple, but they have involved a considerable degree of care in their arrangement. The vessel has a light schooner rig, which is, however, only intended to steady her. Quarters for officers and crew are provided in the poop and forecastle, and, though somewhat small, are well arranged. In its general construction, the vessel is very light, and in order to give the necessary strength, considerable ingenuity has been exercised in substituting elaborate workmanship for the less expensive but heavier stiffening which material gives. The details of the ship are of the type usually employed in Her Majesty's Navy, and are consequently possessed of a very high efficiency, but expensive. As an illustration of the truth of that statement, it may be mentioned that cast-iron

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has never been used if brass could be made to take its place; and the very best timber has been utilised for any and every purpose throughout the ship."

At the measured mile the Scout attained a speed of 17 knots. It has been objected that this speed is insufficient. Let us see how the Scout compares with the Condor type, of which four are now being built for the French. The Condor is 1280 tons, the Scout is 1430 tons; the estimated speed is the same, but in the English vessel that speed is obtained on a vessel of 34 ft. beam as against 29 ft. in the Condor; the Scout will have a marked advantage in stability and in coal-carrying power. The Condor is armed with five light guns; the armament of the Scout consists of four 5-in. breech-loading guns, weighing 36 cwt.; the coal supply is 300 tons in the Scout, and 165 tons in the Condor; the Scout has 11, while the Condor has 5 torpedo-launching tubes.

The Archer.

The Scout was the pioneer of the Archer class. The Archer type was thus described in the *Times* of December 24th, 1885 :—

"The vessel is the first of the six vessels of the Scout class which were contracted for in May of this year to be built for the Admiralty. These vessels were given to the Messrs. Thomson as the result of a competition into which thirty-eight firms were invited to engage. The Archer is 225 ft. long between her perpendiculars, or about 240 ft. over all. Her beam is 36 ft. and her depth 19 ft. Her displacement tonnage is 1630 in what is called her normal sea-going condition, or 1810 tons when fully equipped with all the coals and stores she can carry. The speed of the vessel is expected by the Admiralty to be more than 16½ knots; her builders, judging by the exceedingly successful results of the speed trials of the Scout, are looking forward to nearly 18 knots in this vessel. She is propelled by twin screws, and has engines of 4000 indicated horse-power. The boilers are four in number and of the Navy type, having tubes in the ends of the furnaces; the total weight of the machinery is 350 tons, a weight which in an ordinary merchant steamer's machinery would only be capable of being accompanied by about 2200 indicated horse-power. The gun armament of the Archer consists of six 6-inch breech-loading rifled guns, mounted on central pivoted carriages, and eight machine or rapid-firing guns. The torpedo armament consists of ten tubes, one forward and one aft, each firing in a fore and aft direction above the water, two on each broadside under cover of the poop or forecastle, and one on each broadside in the open part of the middle of the ship. There are also two under-water tubes, one on each side. The protection afforded to the guns and torpedo tubes is partly by means

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of a shield over the rear of the guns or torpedo tubes to protect the men firing, and partly by means of plating, one inch thick, on the ship's side. The ship herself relies upon her very extensive system of sub-division for her protection, the part near the water-line in particular being minutely divided. The coal bunkers are also arranged to give protection to the boilers, engines, and magazines, and the whole of the vital parts are covered by a water-tight deck, a little below the water-line. The vessel has very strong steam-steering gear, placed under water, and acting on a rudder of nearly 100 square feet of area. It is expected that the time to turn a complete circle, with both screws going ahead, will be as little as four minutes, and that the diameter of the circle will not exceed 300 yards. With one screw going ahead and the other astern, the time will be about the same, but the circle will naturally be much less. The amount of coal which the Archer can carry is sufficient to drive her at 10-knot speed for 7000 knots, or for about 2500 knots at full speed. The vessel has two complete decks, the upper and the lower. She also has a poop and forecastle deck, each about 50 ft. long, between which is a high bulwark, forming a hammock netting, and giving the vessel an unbroken sheer line from stem to stern. The bow is formed with a clipper-shaped stem above the water and a projecting ram below the water. The stern is formed like an ordinary merchant ship's, and the appearance of the vessel is very yacht-like, which is somewhat unusual in war ships. Her rig is to be of the three-masted schooner type, with a crow's nest or military top on the foremast for working a machine gun. The vessel is built of steel throughout, and every precaution has been taken to ensure the proper strength with the greatest lightness."

In the two vessels of the Archer class now building at Devonport, the Serpent and the Racoon, the Admiralty have decided to increase the indicated horse-power from 3500 to 4500. Among the smaller craft laid down by Lord Northbrook's Board, the Curlew and the Landrail deserve mention. They are gunboats of a type entirely new in our service. With a view to giving them as much speed as possible, with the lightest draught of water, they are built entirely of steel, as are their engines and boilers, and fitted with the forced draught. Their tonnage is 790, draught of water 10 ft. forward, 11 ft. aft, and they will develop 1200 indicated horse-power; they are 195 ft. long, 28 ft. beam, to carry 250 tons of coals; their estimated speed is 15 knots; their steaming distance at 10 knots will be 10,000 miles. They will carry three 5-in. breech-loaders and one 6-in. on Vavasseur mountings, 10 Whiteheads, and several

The Curlew and Landrail.

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machine-guns, with an electric search-light. It is expected that they will attain the speed of not less than 15 knots. The cost will be about £33,000 for the hull without fittings, and for machinery about £13,000.

The Grasshopper.

Passing to the new type produced under the late Conservative Board of Admiralty, the great aim in the Grasshopper class has been to ensure the sea-going qualities which are essential in vessels designed to act at sea in combination with squadrons. The following description of the new vessel is taken from the *Engineer*:—

"The latest ideas upon torpedo boats and torpedo attack, as evolved by our own and that of other navies' evolutionary practice, seem to be leading to a definite system of attack and defence by torpedo boat squadrons. Speed, handiness, and smallness of target are the strong points of the class of boats which, in our Navy, are called first-class boats. Their speed is between 19 and 20 knots in a normal fighting condition, their displacement is about 60 tons, their length is a little over 100 ft., and their time for turning a complete circle about 1½ min. They usually carry two or three torpedo tubes, and in war time will have two torpedoes for each tube—one in the tube, the other in reserve. They also have one, and sometimes two, small machine-guns. The weak points of these boats are their want of comfort for the crew at sea; their small radius of action or distance to which they can operate from any base; their complete want of protection from even the lightest machine-guns, and their great loss of speed in rough weather. These boats are cheap, costing about £10,000 or £12,000 each when complete, and can be rapidly built. But it is now beginning to be seen that these small vessels are not all that is necessary for either attack or defence. The Admiralty have already, in the Scout class, produced vessels which remedy the defects of want of comfort for the crew, want of protection for the machinery and torpedoes, and small radius of action; but these defects have only been made good at the sacrifice of from 2 to 3 knots of speed. The Admiralty have, however, recently produced a design for a class of vessel which is called the torpedo-gunboat, and which appears to embody some of the good points of the first class, while avoiding some of their defects. Two of these vessels are to be built in Her Majesty's dockyards, and one by Messrs. Laird, of Birkenhead. Their dimensions are—length between perpendiculars, 200 ft.; breadth, 23 ft.; depth, 13 ft. The displacement is 450 tons; the torpedo armament is one tube through the bow and one through the stern in a fore and aft line, and one on each broadside on deck capable of training through 90°; the speed is to be from 19 to

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20 knots; the engines are two sets of triple expansion of the vertical type, and the boilers are four in number, of the locomotive type. The two engines are in one compartment, and the four boilers are in two compartments; the indicated horse-power is to be 2700; the cylinders are 18½ in., 29 in., and 42 in., by 18-in. stroke, and the grate surface of the boilers is 120 square ft. The boilers are to be protected at the forward end and at the sides by coal bunkers, and the engines have protection in the form of ¾-in. plating in the ship's side. The gun armament is one 4-in. breech-loading gun and four 3-pounder rapid-firing Hotchkiss. The steering gear and rudder-head are under water. A forecastle and poop are to be fitted. The conning tower is formed of 1-in. plating, and a conning bridge is to be fitted over it for navigation in ordinary times. An electric search-light is to be fitted above this bridge. In the matter of speed and torpedo armament this type is at least equal to an ordinary first-class boat. In handiness it is probably inferior, for though the vessel is to have twin screws, her much greater length will more than compensate for this. In gun armament the new type is very much superior, and has sufficient offensive power to do considerable damage to all but the most heavily-armed ships. In seagoing qualities, and in comfort for crew, this type is a great improvement upon the smaller boats, but it is principally in the matter of protection that a great advance has been made. The coal bunkers abreast of the boilers, and the thick plating abreast of the engines, will go a long way towards keeping out the shot and shell of the rapid-firing and machine-guns which have become the usual fitting in sea-going war ships. This type of vessel appears to be well adapted to act offensively against a squadron of first-class boats, for her gun armament could not fail to seriously cripple and probably rapidly destroy any torpedo boat, while she herself could not be readily injured either by shot or torpedo."

Historical sketch.

The following historical sketch of the construction of sea-going torpedo vessels for foreign navies is taken from the *Times*:—

"Nearly ten years ago the authorities of the German Navy decided to construct what may be fairly termed the pioneer vessel of this class; and it is somewhat singular that their action was so long left uncopied. The Zieten was built in this country at the Thames Iron-works, and completed in 1876. She was about 200 ft. long, 29¼ ft. broad, and of rather less than 1000 tons displacement. On trial she attained the speed of 16 knots, which was remarkable for a vessel of her size, and reflected great credit on the Messrs. Penn, who made the twin-screw engines of about 2500 horse-power by which she was pro-

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pelled. Two torpedo tubes for ejecting locomotive torpedoes were fitted under water at the bow and stern; the gun armament included four 12-centimètre guns and four machine-guns. Rumour has it that equal success was not attained with the torpedo apparatus as with the other details of the design; and if this be true it would account for the fact that no other vessels of the class were added to the German fleet. About the same time the Italians endeavoured to construct a new type of torpedo vessel, named the Pietro Micca. Her length was 200 ft., breadth nearly 21 ft., and displacement only about 550 tons. It was reported that she was to steam at the very high speed of 18 knots an hour. Unfortunately, she proved a failure in this respect, and is scarcely recognised now as belonging to the torpedo cruiser type.

"In England nothing of the kind was done, unless it was the building of the small and slow torpedo-practice vessel Vesuvius. But in other countries similar attempts were made. In the United States the special torpedo vessels, Alarm and Intrepid, were constructed, of dimensions ample for sea-going purposes; but their speed was below the standard necessary for efficient torpedo work. In Sweden the Ran, of 640 tons, was built in 1877, but her speed was under 13 knots. The Germans about the same time built the nondescript torpedo vessel Uhlan, of 370 tons and 12 knots speed. The construction of the Polyphemus, torpedo ram, was begun in 1878, but she scarcely comes under the designation 'torpedo cruiser,' and, indeed, stands quite alone up to the present time among war ships.

"The Austrian authorities made the next move by the construction, in 1879, of the Zara and Spalato, followed by two similar vessels. These cruisers were about 180 ft. long, 26¼ ft. broad, and 850 tons to 900 tons displacement. They were to have a speed of about 16 knots an hour, and were fitted with locomotive boilers and quick-running engines. The propelling apparatus did not succeed as was hoped, and the vessels attained only 14 knots on trial. While useful for many services, this diminution in speed made the Zara and her consorts far less efficient for torpedo work than the designers had intended. After an interval of some years a new departure was made by the French, who laid down four torpedo cruisers of the Condor class and five torpedo avisos of the Bombe class. This action was taken about 1882–3, and has had a very important influence on other navies. M. Normand, of Havre, deserves most credit for the introduction of the Bombe class. They are about 180 ft. long, 22 ft. broad, 6 ft. draught, and 320 tons to 350 tons displacement. The estimated speed at load draught is 17 knots, and there is good reason

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to expect that this will be exceeded. They are armed with two 14-centimètre guns, three machine guns, and two torpedo-ejecting tubes fitted above water."

The correspondent of the *Times* describes the Condor class as follows:— The Condor.

"The Condor class, designed by M. de Bussy, are about 216 ft. long, 29¼ ft. broad, and 1300 tons displacement; their estimated speed is 17 knots, and their armament includes five 10-centimètre guns, six machine guns, and two above-water torpedo tubes. The Condor class is obviously large enough to be capable of continued independent service at sea, has good accommodation for officers and men, and carries a type of boiler which is economical of coal consumption at all ordinary speeds. Its adoption in the French Navy led to corresponding action by our Admiralty, and early in 1884 the Scout was ordered to be built by contract."

The scheme which has recently been put in execution for the resuscitation of the Spanish Navy includes some important additions to their torpedo flotilla. The following description is from *Engineering*:— Spanish torpedo vessel.

"Messrs. Thomson, of Clyde Bank, have contracted with Admiral Illeycas, on behalf of the Spanish Minister of Marine, to build a vessel to act as a torpedo boat destroyer. She is to be 350 tons displacement, and her length 180 ft. Her torpedo armament is to consist of two tubes through the bow and one through the stern; but none on deck. Her gun armament is one of 9 c. m. Hontario's gun in the bow, four 6-pounder Hotchkiss, and two 4-barrelled Nordenfelts. She has triple expansion engines and locomotive boilers, the engines being in two separate compartments, and the boilers in four. The power of the engines must be more than 4000, as the speed which is expected is 22 knots. Both boilers and engines are completely surrounded by coal, and there is in addition a shield of 1 in. round the engines. The design of Messrs. Thomson provides fully for an end-on attack and defence, for a steel bulkhead 1¾ in. thick extends across the ship before the boilers. The size of this vessel will necessarily give her much greater sea-going qualities than any torpedo boat. She will be faster and handier than the larger English boat, but her torpedo armament is not quite so powerful for broadside firing, but appears to be designed almost wholly for end-on attack. Her coal endurance is for 4000 knots at 10 knots per hour."

The Panther, a fine torpedo vessel, has recently been built at Elswick for the Austrian Government.* Austrian torpedo vessels.

* A description of this vessel, taken from the *Times*, will be found in Part II.

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Torpedo boat on the "turn-about" system.

A smaller vessel, also designed as a torpedo-boat destroyer, has lately been purchased by the Admiralty from Mr. J. S. White. The following description is taken from the *Times*:—

"During the past four years we have on various occasions noticed the gradual development of the invention of Mr. John Samuel White, of East Cowes, which is now popularly known in the service as his 'turn-about' system. Boats built according to this plan have their deadwood removed in order to obtain facility in turning, and are fitted with an inner and an outer rudder, simultaneously actuated, either of which would suffice to steer the vessel in the event of the other being lost or disabled. The present experimental torpedo boat was undertaken by Mr. White for the purpose of demonstrating the applicability of his invention to larger vessels, and with a view to her acceptance by the Admiralty on her fulfilling all the conditions guaranteed. She is considerably larger than any of the existing torpedo craft in Her Majesty's Navy, being 150 ft. long, 17 ft. 6 in. broad, and 9 ft. 6 in. deep. Her displacement is about 125 tons. Her lines resemble those of similar vessels now in use, but she is fitted with a turtle deck and a spur ram. Like the others, she is built of thin steel, and has a conning tower amidships, from whence she will be steered in action. A great feature in the design is the division of the boiler-room by a longitudinal watertight bulkhead, the connections being arranged so that either boiler can be worked independently."

The trials at the measured mile resulted in the realisation of a mean speed of 20·79 knots. When going at that high speed Mr. White's boat can be brought to a complete stop in a few seconds. On being tried in the usual manner for manœuvring-power at full speed with the helm hard over 30°, the starboard circle was completed in 1 min. 17 sec. (238 revolutions of the engines), and the port circle in 1 min. 12 sec. (270 revolutions). At half speed the starboard circle was completed in 1 min. 14 sec. (237 revolutions), and the port circle in 1 min. 15 sec. (246 revolutions). The diameter of the circles was about a length and a half of the boat, or 225 ft. It has not yet been decided whether she shall be used as a torpedo boat or torpedo catcher; but, after she has been taken over by the Naval authorities, £6000 will be expended on her before the final trials are entered upon. As a torpedo catcher her armament would consist of three 6-pounder guns, while as a torpedo boat she would carry torpedoes in addition to three 3-pounder guns, and would be able to fire four torpedoes simultaneously.

Of the fifty-four first-class sea-going torpedo boats laid down in

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1885 in addition to the comparatively large craft, the following description is taken from *Engineering*:—

First class sea-going torpedo boats laid down in 1885.

"These boats are 125 ft. long, 13 ft. beam, and have a trial displacement of about 62 tons. The guaranteed speed is 19 knots, but those that have already been tried have averaged about 19½ knots with about 650 indicated horse-power. The feature that strikes one most in stepping on board these craft is the fine expanse of deck which runs flush fore and aft, in place of having a raised structure in the middle and waterways at the side as has hitherto been usual in many of these craft, or else a very much arched deck such as Messrs. Yarrow have fitted. The deck of these boats is raised to the same height as the top of the superstructure in other craft, and this gives a very bold side, the freeboard being, we should judge from seeing a boat afloat light, about 3 ft. 6 in. or so. The new arrangements, of course, give a great deal more room below, as the greatest headroom extends from side to side of the boat. There are two conning towers, one forward and one aft. The armament is not yet definitely settled, but there will be at any rate one torpedo gun built into the vessel forward, and probably two will be attached to each conning tower, giving a power to fire five torpedoes at one time, should the exigencies of warfare ever call for such an expenditure of aggressive force."

Objection has been taken to the delay on the part of Lord Northbrook's Board in ordering the torpedo armament for these boats. It has not been fully understood that the Torpedo Flotilla ordered during the Russian scare were primarily intended to act not as torpedo-boats but as torpedo-boat catchers. If war had been declared with Russia, and our squadron had been sent to the Baltic, these boats would have been required to defend our ships from torpedo attacks. Immediately on an outbreak of hostilities the Russian men-of-war would have been withdrawn into the basins of Cronstadt and Sveaborg, secured from attack, whether by torpedo boats or by ironclads, behind an impassable barrier of booms and obstructions, and under the protection of stone and iron-plated batteries, bristling with powerful guns. Meanwhile, what would have been the position of the British blockading squadron? Our ships being compelled to keep the sea would have been exposed to attack on every favourable opportunity of fog or darkness. We were anxious to devise the best means for giving protection to a squadron placed in so hazardous a situation. The best opinions were unanimous in favour of surrounding the ironclads with a cordon of torpedo-boat catchers. The boats required were similar to torpedo boats in all respects except as to armaments. For the duty assigned to them of defending large ships

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against swift and puny antagonists, offering a small and rapidly moving target very difficult to hit, the armament proposed was to consist, not of torpedoes, but of powerful quick-firing, and machine guns. Peace having been assured, these torpedo-boat catchers will be utilised for defensive purposes. They will be distributed to the several naval stations and commercial harbours at home and to the coaling stations abroad, and they will be armed with the torpedo.

Defence of ports. Steam pinnaces to be fitted with Whitehead and Spar torpedoes.

Having explained our policy in regard to the larger vessels, it may be pointed out that for the defence of our ports a formidable flotilla could be extemporised out of our steam pinnaces. We had an example of what can be accomplished in the interesting operations for the defence and attack on Portsmouth, carried out by Captain Gordon and the officers of the Vernon in 1880. Those who saw the steam pinnaces driven at full speed over the booms will probably be of opinion that for such usage they were better adapted than fragile torpedo boats. Our steam launches, pinnaces and cutters fitted, or which could be fitted, with Whitehead torpedoes and Spar torpedoes, include 250 steam launches and pinnaces fitted with Whitehead torpedo tubes. Of these 85 are distribubed to sea-going ships. We have also 170 steam cutters fitted with spar torpedoes. Of these two-thirds belong to ships. A naval officer charged with the defence of our ports would well know how to utilise these craft in the general scheme of operations.

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CHAPTER XI.

Future Shipbuilding Policy.

In framing our shipbuilding programme for the future, regard must be had to the direction which is being given to naval preparations elsewhere. The ships building and completing are as follows:— **Armoured building. Policy of Foreign Powers.**

France.

Ironclads	Caiman	7,230 tons.
„	Requin	7,200 „
„	Indomptable	7,168 „
„	Terrible	7,200 „
„	Duguesclin	5,869 „
„	Furieux	5,560 „
„	Formidable	11,441 „
„	Neptune	10,581 „
„	Hoche	10,650 „
„	Magenta	10,581 „
„	Marçeau	10,581 „

Italy.

Ironclads	Re Umberto	13,251 tons.
„	Sicilia	13,251 „
„	Sardinia	13,251 „
(Completing)	Andrea Doria	11,000 „
	Ruggiero Di Lauria	11,000 „
	Lepanto	13,851 „
	Francesco Morosini	11,000 „

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RUSSIA.

Ironclads	Alexander II.	8,637 tons.
„	Katherine II.	10,150 „
„	Tchesme	10,150 „
„	Sinope	10,150 „
„	Admiral Nachimoff	7,781 „
„	Alexander Nevsky	7,572 „
„	Emperor Nikolas	8,450 „
„	N.	9,800 „

At the present time indications are not wanting of a general disposition to withdraw from a costly rivalry in armoured building. It is a significant fact, to which allusion has already been made, that while the Germans have only one ironclad in construction, a Vote of Credit of £840,000 has recently been obtained for 70 torpedo boats for coast defence. In France, the policy favoured by the present Minister of Marine has been made known to the world by his own publications, and by those of M. Gabriel Charmes. The naval operations of the future are to be directed, as we are told, not on the battle ships, but on the commerce of the enemy. In pursuance of these views we find, that while no new ironclad was laid down for France in 1885, in 1886 further progress was suspended on two ships which had been commenced. The main expenditure will be applied to the completion of the ironclads in an advanced stage; but fast cruisers and torpedo vessels are evidently destined in the near future to monopolise the resources available for the building of ships.

Ship-building policy of France.

The French have lately laid down the Tage and the Amiral Cecille of 7045 and 5766 tons respectively, protected on the same plan as the Mersey class, and with a speed of 19 knots. The constructors in the French dockyards have been asked to propose designs for cruisers of 4200 tons and 19 knots, and for another class of 2600 tons and 18 knots, both to be lightly armed—they will be commerce destroyers rather than fighting ships. The French have devoted much attention to the torpedo flotilla. The list of vessels in construction comprises three torpedo cruisers of the Condor class, of 1280 tons and 17 knots, seven of the Bombe class, of 320 tons and 18 knots, and eleven sea-going torpedo boats, of 66 tons and 20 knots.

The new ships will possess great speed.

For Italy one cruiser of the first class, one of the second class, and two of the third class, are about to be laid down. The Government of the United States have been authorized to order two unarmoured cruisers of 6000 tons, and three of 3500 tons.

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Our policy for the future.

It is necessary that the British Navy should be armed at all points. But if no new ironclad is laid down elsewhere we may, on the completion of those now in hand, wisely pause before commencing additional ships of the same class. It is certain that they will be costly. Their fighting efficiency in the near future is open to doubt.

Conversions.

The necessity for laying down more armoured ships at present may be obviated by the conversion of existing ships. The reconstruction of ironclads of the older type has been carried out with great success both for the Chilian and Austrian Navies. We might begin with the Audacious class, taking one ship in hand at a time to be modernised as a second class battle-ship, with reduced masts, compound engines, improved armour and armament. Unless we are prepared to modernise, the ironclads of the older types will gradually become a useless incumbrance. They are in good sound condition, and we shall scarcely be prepared to admit that they are worth no more than so much old iron.

Armour.

The development of quick firing guns in the armament of foreign navies has certainly tended to raise the value of armour extended over a larger area of side, as against the more concentrated armour of the later ships.

If more ironclads are to be laid down, the compiler would desire to add some ships of moderate draught. Our most powerful ships cannot pass through the Suez Canal; they are therefore unavailable in waters in which we are bound to provide effective protection for British interests. The French have devoted considerable attention to coast-defence ships of a more powerful type than our Hotspurs and Gorgons.

Programme for 1887–8.

The rapid progress which may be anticipated during the present financial year on all the ships now in hand would enable the Admiralty to present to Parliament, with the Estimates for 1887–8, a large programme of new construction. In that programme should be embodied the excellent proposals brought forward in a recent debate in the House of Commons by Lord Charles Beresford. His programme is as follows:—

No.		Tons.	Knots.	Cost.
				£
5	Australia Class . .	5,000	19	1,000,000
20	Cruisers . . .	2,000	20	2,000,000
4	Hecla Class . . .	5,500	20	1,000,000
16	Grasshopper Class . .	450	20	900,000
40	Falke Class (torpedo boat)	80	23	680,000
				5,580,000

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For the defence of our commerce, it is impossible to be precise as to the standard of strength at which the fleet should be maintained in relation to that of other Powers. The increased expenditure shown in the Estimates for 1885–6, was mainly appropriated to vessels for the protection of commerce. The Archer class were considered valuable, both for these duties and as sea-going torpedo boats. The belted cruisers were the ships more particularly designed, under the late Board, for the protection of commerce. The resources of the Navy in future years may with advantage be applied to the construction of additional vessels of a similar type, but with a speed which should at least equal and, if possible, surpass the utmost efforts of Foreign Powers.

It should be our policy to develop vigorously the strength of the Navy in sea-going torpedo vessels.

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CHAPTER XII.

The Royal Corps of Constructors.

Under the administration of Lord Northbrook a considerable improvement was made in the pay and position of the constructors, both at the Admiralty and at the dockyards. The organisation of the professional department of the Navy had engaged the special attention of Mr. W. H. Smith and his colleagues. A conviction had long been entertained by the Controller and the professional officers on the Council of Construction, that the position accorded to the junior members of their profession was equally unworthy of their responsibilities and of the high attainments which they acquired in their elaborate course of training at the Royal Naval College. The unsatisfactory results of our imperfect organisation were apparent both in the loss of many able men and in the comparative failure of students of Naval Construction at the Colleges. Of twenty-eight students who had obtained professional certificates at South Kensington or the Royal Naval College, no less than twelve had left the service for private employment; and, whereas 98 per cent. of the Engineer students had passed out of the College with credit, only 43 per cent. of the students of Naval Construction had succeeded. With the view to remedy this state of things, a Departmental Committee was appointed. The result of their inquiry was announced to Parliament in the Session of 1883. Commencing at the initial stage, it was proposed that the students of Naval Construction should share in the educational advantages offered at the Schools recently established for the training of naval engineers. As an encouragement to study, and as a means of assisting the dockyard artizans in the education of their sons, it was proposed to create studentships, to be awarded by competition to the boys in the dockyard schools. The studentships were to be of sufficient value to cover the cost of education in the Marlborough and at Keyham College.

Appointment of a Departmental Committee.

Studentships established.

At the Royal Naval College at Greenwich, the students of Naval Construction were to be placed on a footing of equality with the

Position of students at the

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Royal Naval College, improved.

naval engineers. Hitherto the students in the Naval College had received pay at less than half the rate allowed to the Engineers.

An important change was recommended in the position of the students on leaving the College. Under former arrangements the highest appointment open to the students of Naval Construction on passing out of the College was that of draughtsman in the dockyards, where they were entered as "established draughtsmen supernumerary" at six shillings a day. The Admiralty on the advice of the Committee provided more suitable employment for these educated men. Adopting the plan of Sir Houston Stewart, a Corps of Constructors was created with the honourable designation of the "Royal Corps of Naval Constructors." The regulations approved by the Admiralty for the Corps provide a complete scheme of organisation for the professional officers. On leaving the College the student of Naval Construction becomes an assistant constructor with a salary commencing at £110 a year, and will have the prospect of advancement from grade to grade to positions which, both in point of dignity and emolument, will compare favourably with those accorded to any class of the Civil servants of the Crown.

Royal Corps of Naval Constructors established.

Mr. White's historical sketch of the Schools of Naval Architecture. Published in 'Nature,' May, 1884.

The following observations will be perused with interest. They come from the pen of Mr. White, the present chief constructor of the Navy, and the chief collaborateur with Sir Houston Stewart in the preparation of the scheme for the reconstitution of the professional staff of the Navy. Referring to the recent Order in Council, he says:—"An important change has thus been made in the entry, training, and promotion of the professional officers upon whom devolve the responsibilities connected with the design and construction of ships for the Royal Navy; yet little public interest has been evinced. There can be no dispute, of course, as to the great importance attaching to the maintenance in the highest state of efficiency of the constructive department of the Navy. Shipbuilding is making such rapid strides that all who have to take part in its developments, whether for war or for commerce, require a highly scientific as well as a thoroughly practical education, if they desire to keep in the forefront of progress. And for modern war-ships with their high speeds, heavy burdens of armour and armament, and liability to damage in action, specially difficult problems continually present themselves, the solution of which is only possible by means of scientific procedure. Recognising these facts, it may be well to make a brief statement respecting the new Constructive Corps, and to indicate the manner in which its creation may be beneficial not merely to the public service but to the mercantile marine.

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"It is only proper to remark at the outset that the Lords Commissioners of the Admiralty have hitherto been the chief patrons of the scientific education of shipbuilders in England; and to their generosity has been due the existence of the only establishments in which the higher training of naval architects was provided for. Early in the present century (1811) the first School of Naval Architecture was established in Portsmouth Dockyard, and continued at work for more than twenty years. It was established in consequence of the absolute necessity for opposing to the well-trained French naval architects men of equal education and ability, who could not be found at that time in our naval service. Ship-designing was clearly in a very inferior position here, when no shame was felt in building servile imitations of vessels captured from the French. In 1832 this school was abolished, and for sixteen years there was no training establishment of the kind open for English students. But during that interval men educated at Portsmouth occupied important positions both in the Royal Naval Service and in private establishments, helping to maintain our national reputation. In 1848 a second school was opened at Portsmouth on a much more modest scale, and destined to have a shorter life, for it lasted only five years. That brief period sufficed, however, to produce a number of men still holding some of the highest positions in the profession. Another interval of ten years elapsed, and then the Royal School of Naval Architecture was opened at South Kensington, the Admiralty giving it large support, although it aimed at educating other than Admiralty students. Since 1864 there has been no interruption in the good work, although in 1873 the establishment at Kensington was broken up, and the Admiralty section of it transferred to the Royal Naval College at Greenwich. There, as at Kensington, all comers are welcomed if they possess sufficient preliminary training, and private English students, as well as foreigners, have opportunities for instruction afforded them as good as those which the Admiralty provide for their own students. By the munificence of Mrs. John Elder, the University of Glasgow has had a Professorship of Naval Architecture recently established, and the classes will, it is understood, commence work this year. But up to the present time the Royal Naval College affords unrivalled opportunities for instruction, and may challenge comparison with any similar institution in Europe.

"By means of the very excellent training schools in the Royal dockyards, and the large field of selection from among the apprentices, the Admiralty have been able to secure a continuous supply of well-prepared students for the higher training at Kensington or Greenwich

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and thus have obtained the educated naval architects required for the public service. Nor is this all that has been done. A very considerable number of the trained men have passed from Admiralty employments into private establishments, where they have done and are doing good work.

"It may be asked, in view of these results, why change a system which has worked so well? The answer is two-fold. First, there were grave objections to the continuance of the restrictions imposed by the regulations for first entry into the service. Second, there was not proper recognition of the special training which a student had received when he passed out into actual work, nor any guarantee of a subsequent career. These points require brief explanation.

"Although the Admiralty so fully recognised the value of scientific training for its naval architects, and made provision for it, yet for half a century they maintained regulations which necessitated the first entry into the service being made either as an apprentice or as a working man. A few exceptions may be quoted; but the general rule was as stated. The result of this arrangement was that, with few exceptions, candidates for entry came from the working classes; and there was no attraction into the service of the sons of persons in good social positions, such as very commonly become pupils of civil or mechanical engineers. This was obviously a matter which required alteration. The competition for entry was absolutely free, no doubt; but it was surrounded by conditions which made the real field of selection narrow, and did away with many possibilities of attracting well-educated youths into the service.

"Competition was of the essence of the whole system—unlimited and fierce. There was an open competition for entry as apprentice, with probably ten times as many candidates as there were appointments; then from amongst each year's successful candidates—perhaps thirty or forty in number—three only could reach the Naval College after five or six years' work and frequent examinations. Supposing the College course successfully passed, and the student launched on his professional career as a fully certificated naval architect, he then only began a fresh series of competitive examinations on the result of which depended his future promotion. This was a second objection to the old scheme: it was much the same as if a wrangler were called upon to begin work as teacher in an elementary school, and to compete for that position in elementary subjects with men who knew little or nothing beyond those subjects.

"Both these objections have been disposed of by the constitution

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of the Constructive Corps. For the future, while the apprentices in the dockyards will still retain the possibility of advancement to the highest posts, a new class is to be created, termed 'Students of Naval Construction.' Not more than three are to be entered annually by open competitive examination; they will receive special training at Portsmouth for six years in both professional and educational subjects, living meanwhile in quarters there, and receiving the same treatment as is given to the students in course of training as engineer officers of the Royal Navy. No possible objection need be felt by any gentleman in placing his son under these conditions, and the training is certain to be thorough. Once entered at the Training School, a student has a definite career before him, provided he is well behaved and diligent. He has simply to pass certain standards to insure entrance into the Naval College; and similar conditions hold good during his stay there, as well as at his graduation therefrom. Very properly powerful inducements are offered to the students in order that they may exert themselves and pass out in the highest class; but those who pass the standard fixed are to receive appointments at once as Assistant Constructors in the Royal Navy. With position thus assured to begin with, and with duties to perform suited to the special training received, the graduates of the Naval College can look forward to an honourable and useful career in the Constructive Corps. Promotion throughout the subsequent stages is to be by selection, and not by competition, selection being governed by the reputations which men make in their professional work.

"There are many degrees of rank in the new corps, reaching up from the junior assistant constructors, to constructors, chief constructors, and the highest office—that of Director of Naval Construction, now so worthily filled by Mr. Barnaby. But from the highest to the lowest all the members of the corps have recognised positions in due relation to one another. This is a great gain.

"Still another notable feature in the new arrangements is the possibility which now exists for a naval architect who has obtained his training outside the Admiralty service to enter it after he has proved his capabilities for the appointment of assistant constructor by passing a test examination at the Royal Naval College. There are certain limits of age laid down, and it is possible that the number of candidates who will present themselves for some time to come will not be great. At the same time the Admiralty have shown a wise discretion in thus extending the field from which their shipbuilding officers may be recruited. The private trade has drawn largely hitherto from the Admiralty staff: perhaps some return will be made in future.

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"In the Constructive Corps are included all the principal officers at the Admiralty and in the Royal dockyards, and all the specially educated men from the Naval College who have been successful in their course of study. Provision is also made for admission to the corps of subordinate shipwright officers from the dockyards who may be qualified for the appointment. This is a matter of less public interest than those above mentioned, but it has a very important bearing on the discipline and smooth working of the dockyards.

"These are the main features of the new arrangements. They promise well for the future. While retaining for the apprentice class their possibilities of advancement to the highest positions, the Admiralty have greatly enlarged the field of selection for their constructive staff, and made it possible for any gentleman to place his son in the Training School at Portsmouth with the assurance that the surroundings will be as suitable as the system of training is excellent. Further, the Admiralty have recognised the wisdom of training men who, from the first, shall take rank as officers, and not be compulsorily forced through the grade of workman in order to become officers. This is what is done in all the principal foreign navies and in private establishments: it need not involve any loss of practical knowledge of details, and it is a gain from an administrative point of view.

"For my present purpose it will suffice to terminate here this sketch of a 'new departure' which promises well for the Royal Navy, and to which most people will wish entire success. There are matters of detail which seem open to criticism, and it would be interesting, did space permit, to show in what respects the new regulations resemble or differ from the corresponding regulations in force in the French or other foreign navies. As this could not be done within the limits of this paper, I have been content to draw attention to the openings which the Admiralty have presented to youths who have a taste for naval architecture, but who would not submit to the drudgery of an ordinary apprenticeship; and have endeavoured to point out how the public service may be benefited by the changes introduced.

"The shipbuilding profession has hitherto been a very 'close' one, both in the public service and outside it. But it may be reasonably anticipated that, at least in the Royal Navy, and possibly in private establishments also, a change of system would prove advantageous. If the conditions for admission and training are made to resemble more closely those holding good in various branches of engineering, there seems no good reason why a larger number of well-educated and intelligent young men should not adopt naval architecture as a

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profession. The new Constructive Corps has been created on the recommendation of a Departmental Committee, of which Sir Thomas Brassey was chairman. The Report of this Committee, as well as the minutes of the evidence taken by them, have been published as a Parliamentary Paper (No. 277 of 1883), and will well repay perusal. It may there be seen that the appointment of the Committee resulted chiefly from action taken by Admiral Sir Houston Stewart, when Controller of the Navy: and it is a matter of great gratification to myself that I had the honour of assisting that distinguished officer in the preparation of the scheme, which was substantially recommended by the Committee for adoption, and has been adopted by the Admiralty. A few years' experience will decide whether or not the benefits anticipated from the changes above described will be realised. Much must depend, no doubt, upon the manner in which the scheme is developed, and the process must be gradual and carefully watched if it is to be successful. But whatever the result may be, nothing but good can come from the changes which enlarge the field of selection for the shipbuilding officers of the Royal Navy, and which unite in one corps all ranks and classes of the constructive staff."

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CHAPTER XIII.

Naval Preparations in the Colonies.

Any view of our position as a Naval Power would be imperfect which did not include in combination with their Imperial mother her Colonial children, from whom she has lately received such a generous and noble testimony of their readiness to help her in her hour of need. "The Queen of England," as Lord Elgin truly said in a speech delivered during his administration of the Government of Canada, "is the Sovereign of an Empire growing, expanding, strengthening itself from year to year, striking its roots into fresh earth, and drawing new supplies of vitality from virgin soils." We could have no more conspicuous example of that elasticity of resource, of which Lord Elgin spoke, than that afforded by the magnificent Colony in which he was serving. In her mercantile tonnage the Dominion now ranks fifth of all the nations of the world, and 87,000 seafaring men hail from her ports. Newfoundland is still more remarkable as a nursery for seamen. No less than 41,000 sailors familiar with square-rigged vessels may be counted in her slender population. We may add to these seamen those skilful boatmen who have recently furnished 600 volunteers to the Nile Expedition. We have an admirable recruiting ground for a sea militia in our North American Colonies, among men of our own race, and devoted subjects of the British Crown. Until within a very recent period, the splendid resources at our disposal for the enrolment of a Colonial Naval Reserve were utterly neglected. On his return from a voyage to the North American Colonies in 1872, the compiler did what he could to bring the question before the public. After a long delay, he has at last the satisfaction of knowing that the work has been taken up seriously, though not by the Admiralty. It is in far more competent hands for such a task. It is being carried forward by the local Governments themselves.

Canada.

Newfoundland.

Australian Colonies.

Crossing the Pacific to our magnificent Colonies in Australia, great attention has been given to the defence of their busy sea-ports. An

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address recently delivered by Sir William Jervois before the New Zealand Institute, gives a concise statement of the measures which have been taken largely under his direction. In that address he says:—"Of late years the Governments of the several Australian Colonies (I do not include Western Australia) have incurred considerable expenditure in providing defences for their principal ports. In 1877, accompanied by Colonel (now Major-General) Scratchley, at the request of the several Governments concerned, I visited all these Colonies, and proposed measures for the defence of Port Phillip, Port Jackson, Newcastle, Brisbane, Port Adelaide, Hobart, and other places. I am glad to say that—thanks to the zeal and energy of Major-General Scratchley, who was charged with the carrying out of the works—the recommendations made by me are now far advanced towards completion. At Port Phillip batteries have been constructed and armed for the defence of the entrance and the West Channel, and a torpedo establishment has been provided with a view to applying torpedo defences in suitable positions in the channels within 'the heads.' A design for an important marine fort, which forms part of the system of defence—with reference to which, accompanied by Major Cautley, I recently held a meeting at Melbourne with all the authorities concerned—has been prepared, but awaits a final settlement of the details before it is carried into effect. As regards floating defences, Victoria possesses the Cerberus, a 2-turreted ironclad monitor; the old line-of-battleship Nelson; two fine gunboats; and three torpedo vessels—one, the Childers, a specially powerful craft. Guns will also be mounted in vessels belonging to the Harbour Department of Melbourne. At Port Jackson forts and batteries have been constructed and armed, and a casemated battery, with iron shields, is now in course of completion. Torpedo defences have also been provided there. In connection with the defence of Sydney a fort has also been erected at Botany Bay. The defence of the important coaling station at Newcastle has been provided for by a fort and by torpedoes. The Government of New South Wales also possesses the Wolverene, as a man-of-war training-ship, besides torpedo vessels. South Australia has provided a fine vessel of war—the Protector, 900 tons—for the defence of her seaboard, in addition to land batteries at Port Adelaide. The Government of Queensland has constructed a work to command the approach to Brisbane, besides providing two gunboats and two torpedo vessels, which will soon leave England for that Colony. In Tasmania, batteries and torpedoes, besides a torpedo vessel, have been provided for the defence of Hobart. In the Australian Colonies, moreover, military and naval forces have been organised, or are in

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course of organisation, and the services of officers of the Imperial Navy and Army have been obtained as desired by respective Governments."

New Zealand.

The measures to be taken by New Zealand for the defence of her coasts have been of late under the careful consideration of the Colonial Government. The Colony has four spar torpedo boats of the second class, 63 ft. long, with a speed of 17 knots, which were built by Messrs. Thorneycroft. One of them has been fitted with gear for the Whitehead torpedo. The mercantile marine of New Zealand possesses several steamers suitable for conversion into mercantile cruisers. To provide for the manning of these vessels a force of Royal Naval Artillery Volunteers has been enrolled. Two years ago their strength was 530, and 419 were efficient. Sir William Jervois has recommended forts for the defence of each of the chief ports of New Zealand. He considers that all his recommendations could be carried out for £400,000.

Strategical importance of Australia.

Lying as it were on the eastern flank of our Indian Empire, commanding from their northern shores the great ocean highway to China, Japan, and the Eastern Archipelago, and in a central position for the development of commercial relations with all the most valuable islands in the Pacific, Australia and New Zealand occupy a most important commercial and strategical position. They should receive cordial encouragement in the laudable ambition to provide for their own self-defence. In securing themselves from attack they are rendering a great service to the mother country. Their armed vessels, few as yet in number, are the beginning of a colonial navy, which will in time enable us to reduce materially the Imperial Squadron in those seas. Upon their co-operation we may always rely in case of need. The Colonies have taken the steps, which have been briefly detailed, not from any desire to weaken the British connection, but in a manly spirit of independence, and to relieve the mother country of burdens which the Colonies themselves are well able to bear. It would be a handsome recognition of the colonial navies by the mother country if the privilege of flying the white ensign on their public vessels were conceded. In coming to a decision on this point the Admiralty would not be acting unwisely in yielding more easily to the sentiment and feeling of the Colonies than to considerations suggested by official prudence.

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CHAPTER XIV.

Defences of the Coaling Stations.

The defence of our coaling stations is of urgent importance. The subject has occupied the attention of successive Governments, but they have shrunk from undertaking the task, under an apprehension of the enormous expenditure to which they might find themselves committed. Looking at the experience of the past, such apprehensions cannot be regarded as altogether without foundation. The fortifications of our home ports have involved an expenditure of many millions, and a visit to Bermuda cannot fail to impress the traveller with the conviction that the defensive works have been unduly extended. To man them properly, a garrison of at least 6000 men would be required. The permanent force in time of peace is 1600 men, and it may be questioned whether a sufficient addition to the strength could be spared, even under the apprehension of war. The Royal Commission on our Colonial Defences arrived at the conclusion that a comparatively moderate sum would suffice to place all our foreign stations in a position of defence against the attacks of the light vessels of an enemy. It is certain that we have nothing to fear from their ironclads. Having regard to the limited number of such vessels at their disposal, no European Power could venture to weaken the means of home defence in time of war by sending fleets of ironclads to distant quarters of the globe. The charge on the Imperial funds could be kept within reasonable limits. The Australian Colonies are fully prepared to provide their own local defences. The revised Estimate, approved by Mr. Gladstone's former Government, amounted to £976,760 for coaling stations of the first class, comprising Aden, Trincomalee and Colombo, Singapore, Hong Kong, Cape of Good Hope, including Mauritius, Jamaica, and St. Lucia. From this amount should be deducted the sum of £330,470, contributed by India and the Colonies, leaving an Imperial charge for works and armament of a little over £646,000. For the defence of second class stations the estimate was £178,500. The

Expense to be incurred.

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expenditure for fortifications and for submarine defence brought the total charge on the Imperial funds to the sum of £824,900.

Works of defence already provided.

In the discussion on the Estimates in the present Session the steps which have been taken to push forward the defence of the coaling stations were described by Mr. Woodall. He gave an assurance to the House that at Malta, Halifax, and Bermuda, the submarine defences were on a scale so complete as to make those places absolutely secure against an attack by sea, and that at Hong Kong and Singapore the land defence works could be completed in 1888. The torpedo flotilla had not yet been provided. The spirit in which the Colonial Governments had co-operated with the Imperial Government justly received a warm tribute of acknowledgment.

In this connection attention may appropriately be directed to our requirements at other strategical positions of great importance. At Gibraltar the want of any dock accommodation is a grave deficiency. The greatest battles of the past have been fought near the entrance to the Mediterranean, and the battles of the future may probably be fought in the same waters. The new weapon, the torpedo, will deal its blow below the water-line, and inflict injuries which can only be repaired in dock. Our requirements at Gibraltar might be met, as at Hong Kong and the Cape, by co-operation between the Admiralty and private enterprise. It is another grave deficiency that we have not at any part of our great Indian Empire the means of docking an ironclad. Passing from the East to the West Indies, Jamaica is acquiring increased importance in connection with the canal through the Isthmus of Panama. We maintain an establishment at Port Royal at a cost of more than £8000 a year, but such is the poverty of the local resources, that when the receiving ship, the Urgent, required repair she was towed to Bermuda. To make the naval yard at Port Royal efficient a dry dock should be provided, and this might be effected by private enterprise, with the aid of a moderate subsidy. The dock need not be adapted to the reception of the largest ironclad.

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CHAPTER XV.

Mercantile Auxiliaries.

Policy of Lord Northbrook.

The policy of Lord Northbrook's Board in dealing with the reserve of cruisers in the mercantile marine was in accord with the plans approved by the late Mr. Ward Hunt and Mr. W. H. Smith.

It has been stated that until recently no increase had taken place in the amount of unarmoured tonnage annually built. There was no reason to anticipate that, in a time of profound peace, public opinion would have been prepared to accept such an increase in the Navy Estimates as was proposed for 1885–86. Assuming that the Administration must be content to make the best use of a limited sum of money, the efforts of Lord Northbrook and his colleagues were concentrated mainly on vessels of a class which could not be obtained from any source external to the Navy itself. It is obvious that for ironclads we must depend entirely upon special construction for naval purposes. For the defence of our commerce against fast merchant steamers, taken up by an enemy and converted into cruisers, vessels of a similar class might be selected from our mercantile marine. The views entertained by the Board were, it is believed, very fairly conveyed in a speech delivered at Birkenhead by the present writer, in December, 1882. In insisting upon the intimate connection between the fighting Navy and the mercantile marine, it was said: "Your shipbuilding yards may be regarded as so many supplementary dockyards. Your powerful steamers become transports or cruisers. Your seamen and engineers are an inexhaustible reserve for the Navy. Unless we could rely on the mercantile marine to help us it would be impossible to accept the responsibility of protecting our commerce with the present estimates, or indeed with any estimates which Parliament could be induced to vote." It was an essential part of the policy of Lord Northbrook's Board to carry on the work begun by their predecessors, to organise a reserve of cruisers in the merchant service, and gradually to provide suitable armaments.

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Cruisers taken up in 1885.

Our reliance upon the mercantile marine was fully justified on a late occasion. We were able to take up, at a few days' notice, a powerful fleet of cruisers, a list of which is given in the following Return :—

RETURN showing the Number, Names, Tonnage, and Terms under which the ADMIRALTY Chartered MERCHANT STEAMERS for Employment as NAVAL CRUISERS.

Name of each Cruiser.	Gross Tonnage.	Freight per Ton, per Month.		When Engaged.	Where taken up.	Minimum Term of Engagement.
		Owner Finding Crew.	Government Paying Crew.			
		£ s. d.	£ s. d.	1855.		Months.
America .	5,527	1 2 6	0 15 0	27 Mar.	Liverpool .	6
Oregon .	7,375	1 2 6	0 15 0	28 „	„ .	6
Umbria .	7,718	1 2 6	0 15 0	30 „	„ .	6
Arizona .	5,148	1 2 6	0 12 6	27 „	„ .	6
Alaska .	6,932	1 2 6	0 15 0	27 „	„ .	6
Rosetta .	3,502	1 2 6	£3,000 a month	16 April	En route to Hong Kong	6
Masilia .	4,908	£7,000 a month	£5,000 a month	13 „	Sydney . .	6
India .	4,065	1 2 6	0 15 0	14 „	Colombo .	6
Glenogle	3,749	1 2 6	£3,000 a month	24 „	Hong Kong .	6
Pembroke Castle*	3,936	0 17 6	..	1 „	Suakin . .	7 from 10 Feb.
Lusitania	3,832	1 2 6	£3,000 a month	17 „	Sydney . .	6
Moor .	3,688	1 0 0	0 12 6	14 „	Simon's Town	6
Mexican .	4,668	1 0 0	0 12 6	14 „	Southampton .	6
Coptic .	4,448	1 2 6	0 15 0	18 „	Sydney . .	6
Britannia .	4,129	1 2 6	0 15 0	22 „	Valparaiso .	6
Stirling Castle	4,916	1 5 0	0 15 0	21 „	Malta . .	6

* Originally engaged as an infantry ship for the Soudan Expedition, but diverted after arrival at Suakin, and her period of hire (two months) extended as shown.

W. F. BAUGHAN,
for Director of Transports.

Admiralty, 5th August, 1885.

Several of the vessels engaged were remarkable for their speed. In addition to the well-known American liners, we may more particularly refer to the North America, formerly the Stirling Castle. This vessel was built in 1882 by John Elder and Company. The speed on the trial trip was 18·75 ; the displacement of the vessel is 4899 tons, and the indicated horse-power 8500. Some of the vessels taken up were actually armed as cruisers. The Rosetta was armed at Hong Kong with a 40-pounder on the forecastle, two 64-pounders on the main deck, and 20-pounder and 40-pounder breech-loaders on the upper deck aft, and Nordenfelt machine guns were mounted on the deck houses. The vessel was placed in charge

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of Lieutenant Farquhar, of the Vigilant, and manned by men from the Audacious, the Albatross, and the Vigilant.

Commissioning of Oregon.

The Oregon was actually commissioned as a ship of war, and formed part of the fleet commanded by Sir Geoffrey Hornby. The many useful services which our merchant cruisers could render even to a fleet of ironclads were clearly shown in the course of the cruise. While claiming a high value for our merchant cruisers as look-out ships to squadrons, or for the protection of commerce against privateers, it will be admitted that in vessels specially built for war internal subdivision and the protection of the machinery and boilers can be carried much further than would be possible in ships designed for the purposes of trade. By the recent increase of the Estimates we were enabled to give to our unarmoured construction that development which had been from the first exhibited in our programme of armour construction.

Policy of Lord George Hamilton.

The Board of Admiralty over which Lord George Hamilton presided were not less anxious than their predecessors to maintain a reserve of cruisers in the mercantile marine. They appointed a Committee to consider the best means of utilising the great resources which we possess.

Present arrangements defective.

Our present arrangements are defective in two particulars. The Admiralty requirements as to subdivision into water-tight compartments, and as to the means of defending machinery and steering apparatus by coal armour are not sufficiently stringent; and we have no positive tie to bind the owners of the fastest ships to keep them on the Admiralty list.

Lord Northbrook undertook a journey to Liverpool for the express purpose of conferring on this subject with the leading shipowners of that port. The result of that inquiry was not favourable to the payment of a subsidy. It was considered undesirable to give invidious preference to a few special shipowners. It was anticipated that such a course might possibly tend to the discouragement of enterprise on the part of the general body of shipowners. It is believed that Lord G. Hamilton arrived at a similar conclusion. If this decision should hereafter be reconsidered, a subsidy should be given only for a limited term, and under exacting conditions. A speed of 17 knots is the least that should be accepted.

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CHAPTER XVI.

THE MANNING OF THE NAVY.

THE subject of the manning of the Navy has been reserved for a late chapter in the present publication, but it is of the first importance. It was truly said by an eloquent French writer, "Le personnel est l'âme du matériel." It was in the same spirit that Lord Nelson, in a letter to Sir Hugh Elliott, wrote, "Give me leave to introduce Captain Keats. . . . I esteem his person alone as equal to one French 74." It is certain that the seamen of the present day have never been surpassed. Our naval officers and seamen are as skilful as they are brave. For promptitude of action, for power of combination, for skill in the appropriate use of every description of force which is at the disposal of the naval commander, nothing could excel the simultaneous occupation of the Suez Canal, and the removal, by sea, of the army from Alexandria to Ismailia. The responsibilities of the Navy did not cease with the landing of the Army in Egypt. The fleet continued the base of operations, and the officers and men, landed to co-operate with the Army, did their duty in the field, side by side with their comrades, with chivalrous spirit and devotion.

Efficiency of the personnel.

The impression left upon Lord Wolseley by his long experience in the combined operations of the Army with the Navy was placed on record on a late occasion in a generous speech. "He had himself been brought frequently into contact with the naval service, and he could say, and say from his heart, that it had always been a pleasure, and a real pleasure, to do duty with the members of that profession shoulder to shoulder. It was almost unnecessary for him to recapitulate those many circumstances when he had been acting conjointly with the Navy. There had been recent experience of the admirable and glorious manner in which the Navy helped the Army on the Upper Nile during the recent Egyptian campaign. It had always struck him, whenever he had been brought into contact with the Navy, that there was one particular point in connection with that service which was of a remarkable character, and that was that, numerous as were the times he had served with the Navy, and many as were the officers, old and young, in that service, with whom he had come in contact, he had never met with a bad naval officer.

Testimony of Lord Wolseley.

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That might be a startling statement to make, but he believed it was absolutely true."

Increase in boys for training.

Turning to subjects of a more strictly administrative character, successive Admiralties have come to a common understanding that the force of blue-jackets should be maintained at an average of from 18,000 to 19,000 men. Lord Northbrook's Board accepted this decision, and, finding that the number of boys in training was insufficient, they largely increased the entries.

Extension of C. S. engagements.

Under the same Administration an important alteration was made in the term of continuous engagements. The first period of service was extended from ten to twelve years. The change was not unacceptable to the boys and to their parents, while it will be an advantage to the service to retain men for a longer period. In the small vessels, when first put into Commission, a larger proportion of experienced seamen will not be unwelcome to the officers in command, when caught in heavy weather in the chops of the Channel, or in the Bay of Biscay, on first leaving England.

Reserves.

It is a point of supreme importance to maintain an adequate reserve of men for the Navy. It has recently been decided to equalise the numbers in the First and Second Class, and to maintain the Reserve at a strength of 20,000.

Some doubt has been expressed as to the qualifications of the Second Class Reserve for naval duties. While it is probable that our fishermen would be more at home in gun-boats than in ironclads, in general efficiency and intelligence they would be equal to the men drawn from the same class for the French fleet.

Inscription Maritime.

The fishermen constitute the most important seafaring element in the *Inscription Maritime*. Every seaman, fisherman, or boatman in France must be enrolled upon the books of this organisation as soon as he reaches the age of eighteen. Upon reaching the age of twenty-one, every man enrolled upon these lists must enter the navy. If he wishes he can take his turn of duty at an earlier age. The terms of service vary from one to five years, but the average period of embarkation is not more than three years. The number of men in the Maritime Inscription who have not performed their service in the Navy is about 20,000, of whom 7000 enter the Navy annually. Including marines, liberated seamen, landsmen and conscripts, the total number of men available for the manning of the French Navy may be taken as 120,000. Half of this total are seamen.

It is an inevitable result of the substitution of steamers for sailing vessels that fewer seamen are required, and that the national superiority in seamanship is less important. Hence owners are

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tempted to economise by employing foreign seamen at lower rates of pay. The marked reduction in the number of seamen in the foreign trade must render us more and more dependent on the Second Class Reserve.

Deficiencies in Reserves.

Having referred to the important extension lately given to the Second Class Naval Reserve, the deficiencies in our present organisation demand consideration. Steps should be taken to strengthen the Reserves in officers competent to do duty as lieutenants, and in the engine-room complements. In 1885, in the Evolutionary Squadron, officers were appointed for the first time since the formation of the Reserves to do duty in Her Majesty's ships. The zeal and efficiency they displayed will do much to encourage the Admiralty to place reliance on the Naval Reserve as a source from which lieutenants may be drawn in an emergency. If this policy be approved, it will be desirable to incorporate the midshipmen of the Naval Reserve, more closely than at present, with the Royal Navy, and to instruct them in gunnery. This instruction might be organised at Eastney. At the present time we have ninety midshipmen in the Naval Reserve. All these officers should be invited to volunteer for a short course of training in gunnery, and attendance should be insisted on as a condition of future appointment to the rank of midshipman in the Royal Naval Reserve.

Engine-room complements.

In the engine-room complements generally, we are considerably short of the numbers necessary in time of war. It would not be desirable to add to the permanent force in time of peace. Neither officers nor men would have sufficient practice in their duties to ensure efficiency. The Reserve of Engineers might be fixed at 200. Although these officers would not be required to attend drill, it might be necessary to give an annual retainer, payable while on the active list of the Reserve. It has been decided by Lord Ripon's Board to form a Reserve of stokers from men serving in the Mercantile Marine, and a retainer of £5 a year has been offered to efficient men.

Reserve of Marines.

We have hitherto neglected another valuable source for strengthening the Naval Reserve: I refer to the Marines. In a paper read at the Royal United Service Institution, the officer commanding the London Recruiting District stated that 800 to 1000 men pass out of the Marines annually, who would be eligible to enter the Reserve. By proper organisation, a Marine Reserve of 10,000 men would be available in a few years. The greater number are settled in the vicinity of our principal naval ports. This is a subject which might, with great advantage, be taken up by the present Board.

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Shortly after their accession to office the late Conservative Board of Admiralty decided to give a capitation grant to the Royal Naval Artillery Volunteers. The hesitation of the former Board of Admiralty was due to the want of any well-considered scheme for the defence of our coasts, and to the uncertainty which existed in the minds of our naval advisers as to the precise duties which should be assigned to the Naval Volunteers. The decision of the Admiralty was doubtless taken upon the report of that able officer, Admiral Hamilton, to whom Lord Northbrook had entrusted the preliminary arrangements of a scheme of coast defence at a time when a rupture with Russia was apprehended.

Royal Naval Artillery Volunteers.

Having been associated with the Volunteers from the commencement, the compiler can testify to the zeal which has never flagged, under circumstances of much disappointment. Of their efficiency, the reports received from the officers in command of the gunboats, in which the Volunteers have been embarked, will bear ample testimony. It is superfluous to urge on the Admiralty that care should be taken to make the grant conditional upon a high standard of efficiency. Both officers and men are anxious to qualify themselves for the honourable task of co-operating with the Navy for the defence of the country.

Upon the question of numbers no final decision has been taken. It is desirable to add to the brigades already raised for the Thames, the Bristol Channel, and the Mersey, a similar corps for the defence of the Clyde, the Forth, and the Humber. When this body of trained men has been raised, the Admiralty will be in a good position to provide for the defence of our commercial harbours, in so far as that duty depends upon the Navy.

The flotilla required is already to a large extent provided. We have four armoured turret ships of the Gorgon type. We have twelve gunboats of the Medina type; twenty-four of the Comet, and four of the Staunch type. All these are of modern construction. A large proportion have not been in Commission, and all are represented to be in good condition. The Vote of Credit taken in 1885 enabled us to provide a large instalment of the total number of torpedo boats required.

Flotilla for harbour defence.

In connection with the subject of manning, it is desirable that steps should be taken to deal with the large and increasing proportion of non-combatants in the complement of our ships. In the Estimates for 1885–86 no less than 4460 domestics were provided for. The Admiralty are taking steps to remedy this state of things. Stokers will henceforth be instructed in the use of arms, and marines will be

Non-combatants.

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substituted for certain ratings which have hitherto been filled by non-combatants.

Total Reserves.

Having dealt with the improvements in organisation which seem to be desirable, it may be convenient to give a summary view of our entire Reserves for manning the Fleet. Taking the year 1885, we had in the home ports, in the gunnery, flagships and harbour ships of all classes, and in the Steam Reserve, a total force of not less than 13,000 men. Behind them we had the Marines on shore, 6200; Coast-Guard, 4000; Pensioner Reserve regularly drilled, 1950; Naval Reserve, 19,000; Naval Volunteers, 1600. The total *personnel* of the Navy, including pensioners under 50 and the Naval Volunteers, constituted a force of 86,000 men. The total number on the active list was 57,000, and the complements of all ships which could be made ready in twelve months were 68,000.

Training.

Turning from the numbers to the training of the *personnel* of the Navy, that important subject has been closely watched by the naval advisers of successive Boards. With a view to make officers and men more efficient in fleet duties, the Admirals on Foreign Stations were directed to assemble each year as many ships as possible for cruising in a squadron. The results have been highly satisfactory.

In vessels employed for the training of seamen, efficiency under sail is a primary consideration. The value of the training which can alone be given in vessels capable of being handled under canvas, is acknowledged, not only in our own Navy, but by every Maritime State. An American Squadron of instruction cruising mainly under sail has lately visited our shores, and a French Squadron, composed exclusively of sailing ships, was not long ago cruising in the North Atlantic. We have on the Navy List three ships, the Inconstant, the Shah, and the Raleigh, admirably adapted to form a flying squadron. For the training of ordinary seamen the Cruiser has long been doing excellent work in the Mediterranean. We can provide similar vessels by not fitting up the engines in any sloops in construction, which may be selected for the service. Every mastless ironclad in commission abroad should have a sailing tender. The health, spirit and efficiency of the crews would be greatly improved by cruising at sea under canvas. It would be a welcome relief from the monotony of gunnery and torpedo drill.

Engineer Colleges.

In connection with the subject of education and training, the failure of the engineer students, as occasionally reported by the directors of studies, cannot be passed by. The failure has been attributed to the want of a properly qualified head master. Having incurred the great expense of fitting up the Marlborough, and

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building a College on shore at Devonport, we have hesitated to appoint duly qualified masters for the instruction of the engineers, leaving them entirely dependent upon the schools established in the dockyards for the working apprentices. Such an arrangement is not likely to be successful. Masters are required, of University standing, who would not only teach, but would exercise a valuable moral influence over their pupils.

Officers for navigating duties.

Turning to the officers specially appointed for navigating duties, the training staff, as at present organised, leaves something to be desired. It is certainly not satisfactory that officers should be appointed to navigating duties, even in small vessels, without any previous training in pilotage. The cutters which are no longer required for the coastguard service may be utilised for this purpose. They should be attached to the flagships in the home ports. In the French Navy one steam-vessel and two cutters are specially detailed for instruction in pilotage.

Evolutionary Squadron.

We cannot pass from the subject of manning without expressing the earnest hope that a large Evolutionary Squadron may be brought together every year, not only for the purpose of testing, by experiments, the value of new weapons and new types of fighting vessels of all classes, but for the practical instruction of officers and men. The opportunities afforded to them in the cruise of the Evolutionary Squadron last summer were highly appreciated by all who had the good fortune to serve in the squadron; and any Board of Admiralty may be congratulated which is able to appoint to the command an officer so eminently qualified as Sir Geoffrey Hornby. During the past year naval manœuvres have been executed on a large scale by the Italian, German, and Russian Navies.

We have the means of forming an Evolutionary Squadron at a comparatively small expense. We can easily bring together the numerous ships already in commission. We have the Channel Fleet, and the First Reserve Squadron. To these we may add the Reserve Squadron of Cruisers, which will shortly include the four ships of the Leander type, and four ships of the Mersey type, and which, in another year, may be further strengthened with the belted cruisers. The torpedo flotilla may be formed of any strength which may be thought desirable, by adding to the Evolutionary Fleet the larger vessels of the Archer class and the first-class torpedo boats provided out of the Vote of Credit.

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CHAPTER XVII.

NAVAL INCIDENTS, 1885.

I.—BRITISH EVOLUTIONARY SQUADRON.*

Evolutionary Squadron.

FOR the purpose of testing the practical efficiency of the *materiel* of the fleet, a large squadron was brought together at the beginning of the summer of 1885, and placed under the command of Sir Geoffrey Hornby.

Admiral Hornby in command.

Programme of operations.

In the course of his cruise he was directed by the Admiralty to make a thorough trial in various circumstances of ships and machinery, torpedo boats, offensive and defensive ground mines, and other obstructions.

For this purpose it was assumed that the squadron would operate from Berehaven, in Bantry Bay, on the Irish coast. The squadron was to defend itself against a powerful hostile fleet, and the entrances to Berehaven were to be closed by obstruction.

Torpedo flotilla.

In addition to the larger ships (see pp. 112–15), six first-class torpedo boats of the older type were attached to the squadron. They were fitted with two torpedo tubes on the broadside, and one torpedo tube in the bow. Armament, two Nordenfelts; speed, 18 knots; coal supply equal to 600 knots, at 11 knots; complement, 11, including two officers. Two other torpedo boats were of newer type, and 120 feet in length. They carried two torpedo tubes forward, and one aft; two reserve torpedoes in the magazines, and one Nordenfelt. Speed, 19 knots; coal supply equal to 2000 knots, at 11 knots; complement, 16 men, including two officers. These two boats were also capable of carrying sails.

At the time of the manœuvres, each of the first-class torpedo boats was told off to one of the large ships of the squadron. In any evolutions the torpedo boat would act in combination with the ironclad. The ships to which the torpedo boats were attached were the Minotaur, Shannon, Agincourt, Iron Duke, Hercules, Devastation, Sultan, and Penelope.

* The narrative of Admiral Hornby's proceedings has been mainly compiled from a paper in the 'Austrian Review,' published monthly at Pola.

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At the beginning of the cruise of instruction the squadron was distributed as follows. Order of sailing.

Two Divisions.

First Division: Minotaur, flagship of the Commander-in-Chief of the squadron, Admiral Sir Geoffrey Hornby; Polyphemus, Lord Warden, Shannon, Agincourt (the flagship of Rear-Admiral Whyte), Hotspur, and Iron Duke.

Second Division: Hercules, flagship of Vice-Admiral Sir Anthony Hoskins; Ajax, Repulse, Devastation, Sultan, Rupert, and Penelope.

Three Divisions.

First Division: Minotaur, Polyphemus, Lord Warden, and Iron Duke.

Second Division: Agincourt, Hotspur, Repulse, Devastation, and Rupert.

Third Division: Hercules, Ajax, Sultan, and Penelope.

The corvettes and gunboats were stationed as follows:—

Oregon and Conquest leading the fleet.

On the flanks of the squadron, Leander in advance on the port side, Mariner astern of Leander, Mercury leading on the starboard side, Racer astern of Mercury. Cormorant in the rear.

The squadron assembled at Portland on the 1st of June. On the 10th of June the Mercury, Conquest, Mariner, and Racer joined the flag. They were followed on the 12th by Rupert and Repulse; on the 13th by Cormorant; on the 15th by Penelope; on the 17th by Leander and Britomart. Finally the Oregon and the gunboats Snap, Pike, Medina, and Medway reached Berehaven on the 1st of July. Mustering of squadron.

On a close examination of the individual ships of which the squadron was composed, it will be found that they presented the utmost variety of type, and differed so widely in seaworthiness, evolutionary qualities, speed, armament, and fittings, that it would be scarcely practicable to carry out a combined operation with such a force. Diversity of types.

The following observations are taken from the 'Army and Navy Gazette' of the 13th of June, 1885:—

"The Particular Service Squadron will doubtless have a short life and anything but a merry one. The Admiral will have his hands more than full in trying to hold the reins in driving such a menagerie of unruly and curiously assorted ships. Almost every type will be represented: the fast and the slow, those which can steer and those which cannot; and it will be a source of congratulation if they all get

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Particular Service Squadron.

Name.	Class.	Displacement.	I. H. P.	Max. Speed. Knots.	Coal Supply.		Armament.	Torpedo Fittings.	Armour.	Defensive Appliances.	Complement.	Remarks.
					Tons.	Days at Full Speed.						
Minotaur .	Armoured frigate	10,690	6,870	13	750	4	17 9-in. 12-ton; 2 20-pdr.; 2 9-pr.; 17-pdr.; 6 Nordenfelts; 2 Gardners; 5 Gatlings.	12 Whitehead torpedoes.	6-in. on broadside.	Electric light, torpedo nets.	765	Carries a steam pinnace with spar torpedo.
Hercules .	Casemate ship.	8,680	6,750	13	750	3·3	8 10-in. in the battery; 4 6½-ton on upper deck; 1 9-in. on the bow; 1 9-in. on the poop; 10 Nordenfelts.	2 Whitehead torpedoes.	9-in. armour on the central battery.	2 electric projectors, torpedo nets, 6 electrical contact mines.	633	The steam launch is fitted with countermining gear. The steam pinnace carries the spar torpedo.
Agincourt.	Armoured frigate.	10,690	6,870	12	740 +200 on deck	4	17 9-in. 12-ton; 2 20-pdr.; 8 24-pdr. Howitzers; 2 9-pdr.; 1 7-pdr. boat guns; 6 Nordenfelts; 2 Gardners; 5 Gatlings.	12 Whitehead torpedoes.	6-in. on broadside.	No torpedo nets, 2 electric projectors.	780, of whom 51 officers.	—
Shannon .	Armoured cruiser.	5,390	3,370	11	560	7 18 days at 8 knots.	2 10-in.; 7 9-in.; 6 20-pdr.; 1 9-pdr; 1 7-pdr.; 8 Nordenfelts; 2 Gardners.	12 Whitehead torpedoes, to be fired from the ship or steam pinnace.	9-in. belt with armoured bulkheads.	Torpedo nets, 2 electrical projectors.	507	—

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Sultan .	Casemate ship.	9,290	7,720	12-13	790	2·5	8 10-in.; 4 9-in.; 7 20-pdr.	No Whiteheads	9-in. to 6-in. armour on broadside.	2 electric projectors, torpedo nets.	632	2 second class torpedo boats.
Penelope .	Casemate ship.	4,470	4,700	10·5	473	..	8 9-ton; 11 light guns.	No Whiteheads	6-in. to 7-in. on belt and battery.	No electric projectors, no torpedo nets.	275	—
Devastation	Armoured turret ship.	9,330	6,650	13·5	1,300	6·5	4 35-ton; 10 Nordenfelt; 10 25-pdr.	24 Whiteheads	14-in. on turrets, 12-in. citadel and belt.	Electric projectors, torpedo nets.	410	Steam pinnace fitted with torpedo tubes and the Spar torpedo.
Oregon .	Hired auxiliary cruiser.	7,375	15,750	18	..	10–11	6 64-pdr.; 4 5-in. Woolwich.	..	..	..	..	Carried 8 steam pinnaces with torpedo fittings.
Repulse .	Armoured frigate.	6,100	3,350	12	460	3·4	4 8-in. 9 ton; 8 8-in. 9 ton; 6 20 pdr.; 2 9 pdr.; 1 7 pdr.; 6 Nordenfelt.	2 Whiteheads	5-in. on broadside.	2 electric projectors, no torpedo nets, 6 contact mines, spar torpedoes.	497	—
Lord Warden.	Armoured frigate.	7,840	6,700	10·9	529	2·75	2 9-in.; 14 8-in.; 2 7-in.; 3 9-pr.; 1 7-pdr.; 6 20-pdr.; 2 Nordenfelt; 1 Gardner.	..	5-in. on broadside.	Spar torpedoes on broadside, no torpedo nets, 6 contact mines.	328	Steam pinnace with Spar torpedo.
Ajax .	Armoured turret ship.	8,510	6,400	13	950	..	4 38-ton; 5 4½-ton; 14 light.	..	16-in. on turrets, 14-in. on belt, citadel and athwartship bulkhead.	Torpedo nets, defensive mines, 2 electric projectors.	435	1 torpedo boat, 2nd class steam cutter with torpedo tubes and spar torpedo.

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Particular Service Squadron—*continued.*

Name.	Class.	Displacement.	I. H. P.	Max. Speed. Knots.	Coal Supply.		Armament.	Torpedo Fittings.	Armour.	Defensive Appliances.	Complement.	Remarks.
					Tons.	Days at Full Speed.						
Hotspur .	Ram turret ship.	4,010	3,060	12	300	2·5	2 12-in. 25 ton; 2 6-in.; 1 9-pdr.; 17-pr.; 2 Nordenfelt; 2 Gardner.	12 Whitehead torpedoes.	8-in. on turret, 11-in. to 7-in. on belt, tapering forward and aft to 8-in. to 3-in.	Torpedo nets	224	1 torpedo boat second class, steam pinnace with torpedo tube.
Hecla .	Torpedo depot ship.	6,400	1,760	12·5	1,500	30	4 64-pdr.; 1 40-pdr.; 1 5-in.	3 Whitehead torpedoes, 4 torpedo tubes.	Protective armour, coal armour for machinery and boiler room.	84 500 lb. guncotton and 84 72 lb. guncotton mines, 2 electric projectors.	247	6 second class torpedo boats, 3 steamboats with torpedo tubes and spar torpedoes.
Conquest .	Corvette .	2,380	2,670	13·6	..	..	2 7-in.; 12 64-pdr.; 6 Mitrailleuses.	..	..	..	285	—
Rupert .	Ram turret ship.	5,440	4,630	12·5	480	2	2 18-ton in turrets; 2 6½-ton on upper deck; 10 light guns.	Whitehead torpedoes.	14-in. on turret, 11-in. at water line.	Torpedo nets	200	Steam pinnace fitted with torpedo tubes.
Iron Duke .	Casemate ship.	6,010	3,520	10·6	550	..	10 12-ton; 4 6½-tn.; 4 5-in.; 6 20-pdr.; 10 Nordenfelt; 6 Gardner.	..	8-in. on belt, 6-in. on battery.	Torpedo nets, electric projector.	490	—
Mercury .	Cruiser, twin screws.	3,730	7,290	18·6	..	3·25	10 64-pdr.; 6 Nordenfelt; 4 Gardner.	4 torpedo firing ports.	Coal armour for machinery.	Electric projectors, no torpedo nets.	275	2 second class torpedo boats.

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Leander	Cruiser, second class twin screws.	3,750	5,000	16	1,000	6·5	10 6-in.; 8 Nordenfelt; 4 Gardner.	4 torpedo firing ports.	1¾-in. steel deck, coal armour.	2 electric projectors.	278	2 second class torpedo boats, steam cutter with torpedo, discharging apparatus, and spar torpedo.
Polyphemus	Torpedo ram ship.	2,640	5,500	17·9	240	1·5	2 6-pdr.; 4 1-in. and 4 barrel Nordenfelt in turrets; 2 Nordenfelt 5 barrels per boat.	5 torpedo firing tubes, one firing ahead, four firing broadside; 18 torpedoes.	Protective armour steel, 2 to 3-in. on the turtle back deck. armoured conning tower.	Torpedo nets, 2 electric projectors.	132	2 steam cutters with spar torpedoes and Nordenfelt guns, ship fitted with electric lights.
Cormorant	Spar decked corvette.	1,130	950	10	..	..	2 7-pdr.; 4 5-in. guns; 4 64-pdr.; 6 Mitrailleuses.	..	..	..	156	—
Racer	First class gunboats.	970	850	10·75	..	..	8 5-in.; 1 7-pdr.; 2 Mitrailleuses.	..	..	..	112	—
Mariner												
Snap	Second class gunboats.	254	250	8	..	..	1 10-in. 18-ton; 2 Nordenfelt.	..	..	..	..	Staunch type.
Pike		254	240	8	..	..	1 10-in. 18 ton.; 2 Nordenfelt.	..	..	..	..	Staunch type.
Medway		363	310	9	..	..	3 64-pdr.; 2 Gatling.	..	..	..	..	Two screws, two rudders.
Medina		363	310	9	..	..	3 64-pdr.; 2 Gatling.	..	..	..	..	Two screws, two rudders.

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back again without any of them ramming or running into her neighbour."

Departure from Portland. The squadron left the rendezvous at Portland on the 9th of June in columns of divisions in line ahead, and at once began a course of tactical instruction.

On the 10th of June they were exercised in making sail, the Shannon being the smartest ship. At 11 A.M. the Conquest, Racer, Mariner, and Mercury joined the squadron.

In the afternoon the squadron was again exercised in steam tactics at a speed of eight knots. Instructions were issued that booms would be constructed, to bar the entrances to Berehaven, with the spars of the ships.

Torpedo boat with Mercury in chase. In the evening a first-class torpedo boat was detached with the Mercury in chase, with a view to ascertain whether the Mercury was able to overhaul the torpedo boat. The chase continued through the night, and at daylight on the 11th of June it was ascertained that the torpedo boat had not been able to gain on the Mercury.

Arrival at Berehaven. On the 11th of June the squadron was again exercised in steam tactics. At 3.30 P.M. they anchored at Berehaven.

The two divisions took up such a position that their guns commanded the two entrances which divide Bere Island from the main land.

Injuries to torpedo boats. During the passage four torpedo boats had been damaged, two in their machinery and two from collision. This occurred during the night when the Mercury had been detached in chase. It was necessary to place the two torpedo boats which had been in collision on the beach. The repairs were executed by the torpedo depôt ship and floating factory, the Hecla. The great advantages were thus early demonstrated of attaching such a ship to a squadron which includes a torpedo flotilla, and in which the large ships were fitted with torpedo-tubes, electric lights, and the various auxiliary engines and appliances which form an essential part of the equipment of a modern vessel of war.

Booms. On the 12th of June the preparatory work was commenced for closing the eastern and western entrances to Berehaven with booms. These obstructions were to consist of a double boom, protected on the outside by submarine mines. The booms were formed of the spars of the ships of the squadron, a steel hawser being rove along the booms and set up taut by means of kedges. On the day of the arrival of the squadron at Berehaven it was joined by the Repulse and Rupert.

Blockade of Bantry Bay. On the same day the Mercury, Racer, and Conquest were detached from the squadron, taking with them the six first-class torpedo

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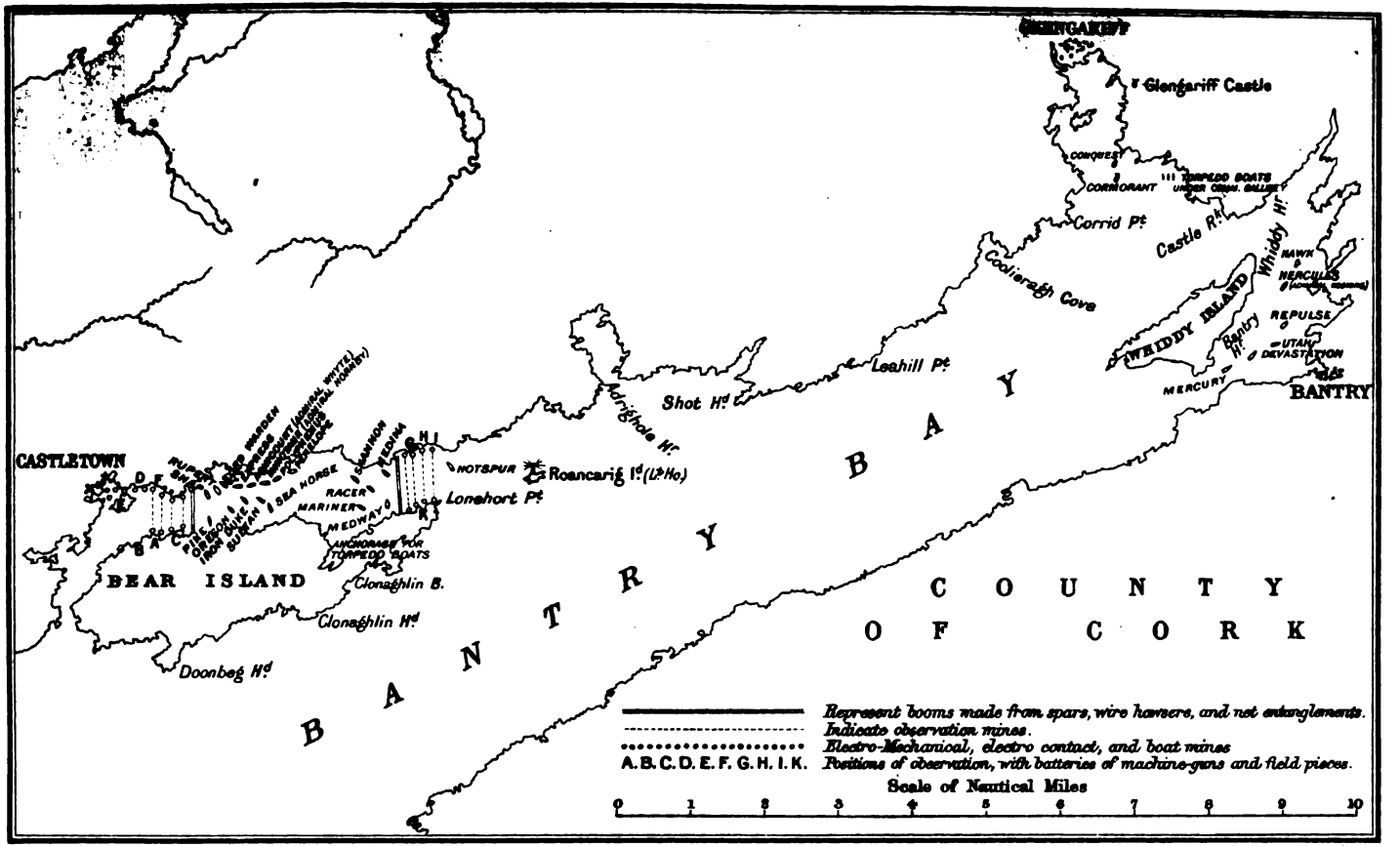
THE PARTICULAR SERVICE SQUADRON.



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boats, which were to form part of the force which was to undertake the offensive operations against Berehaven. Torpedo boats were detached from the squadron for the purpose of watching the enemy. In the night the enemy endeavoured to enter the bay. The Mercury succeeded in pushing in unobserved between the boats on the look-out. The Conquest and Racer were observed and chased by the two second-class torpedo boats.

Explosion in bunkers of Conquest.

On the 13th of June an explosion took place in the coal bunker of the Conquest by which one man was killed. On the same day, the Cormorant and the coastguard cruiser, Hawk, joined the squadron. Both these vessels were attached to the force acting on the offensive.

Completion of booms.

On the 14th of June the booms were completed and secured in position by the Minotaur, Sultan, Lord Warden, Iron Duke, Shannon, Agincourt, and Repulse. At the same time mines were laid outside the booms by the gunnery and torpedo officers. This work could not be completed in one day. It was therefore continued on the 15th. It is open to doubt whether it would ever be practicable to execute such an operation in the presence of an enemy.

The Penelope joined the squadron in the afternoon.

Operations of blockading squadron.

On the night of the 15th and 16th of June the squadron acting on the offensive again attempted to enter the haven. The Racer was observed, although every device had been adopted to make the ship invisible. The hull was not seen, but the bow-wave revealed the approach of the ship. After a long and fruitless chase, the torpedo boats despatched in pursuit of the Racer returned. The Racer renewed the attempt to approach the booms. The torpedo boats were again on the alert, and endeavoured to call another torpedo boat to their assistance. This boat was soon seen from the Racer and put *hors de combat* by the firing of her guns. In the meanwhile three torpedo boats of the squadron made a sortie and chased an enemy's torpedo boat which had attracted their attention. At this moment two torpedo boats, whilst steaming at a speed of fifteen knots, collided and sustained such damage that the affair was practically decided to the advantage of the enemy.

Batteries for defence of booms.

On the 16th of June the booms were completed; the electric contact mines were laid, and, on the point of the shore to which the end of the booms was secured, a battery was formed, and armed with 20-pounder guns. The booms at the east entrance were nearly a mile long.

Attempt to break blockade.

On the evening of the 16th, an attempt was made to break the blockade. It was assumed that the Minotaur, Hotspur, and Shannon,

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were blockaded by the Conquest, Cormorant, Mariner, Racer, and Mercury, together with six first-class torpedo boats. At 11 P.M., in clear calm weather, the three ironclads already mentioned slipped their cables, and went out by the narrow opening which had been left in the eastern boom. The Minotaur led the way to sea, followed at an interval of two cables by the Shannon; the Hotspur bringing up the rear. The lights on board were extinguished, and the crews were stationed at the guns. After passing through the booms, the speed was increased, and a south course was steered along the shore.

It had been hoped that the ironclads had escaped observation from the vedette ships of the blockading squadron, when suddenly ahead of the Shannon a blue light was burnt, and ahead of the Minotaur a rocket was sent up. These were signals that the ships had been seen by the enemy's torpedo boats. Immediately afterwards the torpedo boats were made out, and it was evident that a determined effort would be required to force a way through the ships of the blockading fleet. The order was given to steam at full speed, and a heavy fire was opened on the torpedo boats, which had the effect of bringing up the large ships of the enemy upon the scene. On their approach, the Shannon, Minotaur, and Hotspur, had no alternative but to return, the enemy having the greater number of ships, and the further advantage of superior speed. It can scarcely be doubted that at least one or two of the ships engaged might have been sunk by the torpedo boats. It is quite possible that they might have been unable to regain the protected anchorage. The clear still weather gave the torpedo boats a great advantage. In a dark night and blowing weather the blockade might have been broken.

On the 17th of June, the Leander and the Britomart joined the squadron, and both were at once attached to the blockading ships.

Boisterous weather.

On the 18th of June the weather was so stormy that all exercises were suspended. The booms were injured by the sea, and the moorings of the mines were more or less disturbed. The 20-pounder guns which had been placed in the batteries on the 6th were returned to the ships. After sunset, the Conquest, Mercury, Leander, Racer, Cormorant and Mariner, with the torpedo boats attached to them, got under way to take up their position of observation outside the haven. The weather proved so boisterous that the blockading division returned before it had reached the open water outside. In returning, the torpedo boat No. 21 lost one of the blades of her screw, and the Leander, while manœuvring to keep clear of the Conquest, struck on the Hornet rock, and was seriously injured. As soon as the

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accident occurred the engines were stopped, the watertight doors closed, the pumps were set going, and collision-mats and sails were passed under the ship's bottom. After some time it was found that the pumps failed to gain on the leak. On the following day the ship was moved nearer to the shore, so as to be ready to beach in case of necessity. Early, however, on the 21st the divers succeeded in finding the leak and stopping it with the patent leak-stopper. The ship's hold was thereupon cleared of water. On the 26th of June the Leander, escorted by the Mercury, steamed to Devonport, where she was placed in dock.

On the 19th and 20th of June the weather was very bad, and all important operations were suspended. At first, apprehensions were entertained for the booms. A few spars and some of the mines were washed adrift by the sea. On the 21st the beach was carefully examined for the purpose of recovering the debris. On the 22nd of June the damage done to the booms was repaired, and further experiments were made in jumping the booms with boats. One of the small torpedo boats received some damage from this rough usage.

Programme for attack on booms.

For the operations, which were to be undertaken on the arrival of the gunboats, the following programme was prepared:

Vice-Admiral Hoskins, with the Hercules, Ajax, Devastation, Conquest, Cormorant, and the five first and second-class torpedo boats, was placed in command of the attacking division. Rear-Admiral Whyte had the command of the division anchored in Berehaven and the charge of the defence of the harbour. Admiral Hornby acted as umpire.

The anchorages on the Irish coast were considered as inaccessible and not included in the plan of operations. The defending division was supposed to have occupied the anchorage inside Berehaven. It had taken possession of Bere Island, and had there formed batteries to protect the booms and the ships. Vice-Admiral Hoskins was to endeavour to force the booms at the eastern and western entrance, to seize the island, and to take or destroy the ships inside the harbour.

Ground mines.

On the 23rd of June the defensive mines which had been first laid down were examined, and the gun-vessel Mariner was ordered to keep a watch on the mine-field. One of the sunken mines over which the Mariner passed did not explode, probably because the ship's draught of water was not sufficient to ensure contact. The officers in charge of the mining operations of the squadron complained that the mining stores were in bad condition, that of the many hundred mines, with 500 pound and 72 pound charges, on board the Hecla, the greater number were practically useless.

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Departure of Admiral Hoskins with the attacking division.

In the afternoon Admiral Hoskins with the Division under his command left the anchorage at Berehaven and proceeded to Glengariff, from which point the attack was to be commenced. During this change of position the circulation pump having been broken in one of the first class torpedo boats, she was recalled for repair.

The squadron left behind in Berehaven now broke off all communication with Admiral Hoskins, laid down new mines, and altered the position of the mines and the buoys already laid down. In the night electric lights were brought into use.

On the 24th of June further attention was given to the defences, and instructions were circulated to each ship detailing the part which she was to take in the coming operations. The Polyphemus and the Hotspur were to anchor outside in order to lure the enemy over the mine-field. On both sides a neutral commission was appointed, of which Admiral Hornby, as chief umpire, was named president. Certain rules were subsequently laid down, in accordance with which the results of the operations were to be decided.

Gunboats were thrown out of action if struck by a torpedo, and the Hotspur, the only ship placed outside the line of defences, was also to be considered out of action if struck by a torpedo. The Whitehead torpedoes used for these operations were, it is needless to say, not loaded, but their course could be tracked by means of Holmes's signal lights.

The attacking division, under Admiral Hoskins, was not allowed to put a force on shore, it being assumed that the coast was inaccessible. They might, however, land 500 seamen and marines on Bere Island.

To avoid injuries, the first and second class torpedo boats were not to attempt to jump the booms. They could only pass the line of obstructions when the booms had been broken.

The total number of boats fitted with Whitehead's torpedoes taking part in the attack was twenty-five. On the side of the defensive force on the 24th of June, two first-class boats and three second-class boats were unfit for service owing to collisions and injuries to the machinery. It was hoped, however, to repair them effectually with the resources of the Hecla. The bow of one of those boats was so much injured that it would have occupied scarcely less than two weeks to repair it in a dockyard.

During the first attack the booms were not to be broken, and only dummy charges were placed upon them. If two boats succeeded in placing two such charges the booms were considered to have been broken. On the following day live charges were to be used, and the Polyphemus was to endeavour to force a passage. Later the ironclads

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were to endeavour to pass over the mine-field. The explosion of a mine under a ship, which was to be indicated by the explosion of a small charge, would place any ship *hors de combat.*

In the engagement on shore it was understood that infantry behind works could only be overpowered by a force four times superior to their own.

Signals by electric light.

The communications with the attacking fleet being interrupted, Admiral Hornby wished to delay the operations, as the gunboats had not yet reached the squadron. He accordingly instructed the Shannon to make a signal to this effect with her electric lights. The Shannon made use of electric lights of 25,000 candle-power, but could not convey a signal to Glengariff, a distance of some twelve miles. The Hercules was accordingly placed within signalling distance. The failure was attributed to moonlight, and another experiment was to be made in a dark night.

Double boom.

On the 26th of June, the division anchored in Berehaven added considerably to the strength of the obstructions at the entrances by forming a second boom inside the outer boom, formed of heavy spars, which had been first laid down. The inner boom was formed of light spars, and was three to four yards inside the outer boom. This second boom was held in its place by a 5-inch steel hawser. The booms were connected by means of light spars, and small ropes were stretched from spar to spar, forming a net, so that in case any boat succeeded in leaping the first boom the propellers might be fouled.

Submarine mines.

Outside the booms four rows of observation mines were laid, ten yards apart, and in fifteen fathoms of water. Inside these observation mines, which were to be fired by electricity from a battery on shore, electric contact mines were laid near the shore and fourteen feet below the surface of the water. Still nearer the shore electro-mechanical mines, and inside these again boat mines were laid to prevent the passage of torpedo boats. The three descriptions of mines last mentioned exploded on contact. To protect each of the stations on shore batteries were formed armed with twenty-four field guns and twenty-four machine guns.

Torpedo flotilla. Distinctive colours.

The more readily to distinguish the torpedo boats of the two squadrons, the attacking division under Admiral Hoskins were painted black. Those of the division under Admiral Whyte were painted white.

Umpires.

The umpires of the lower grades were for the most part selected from the non-combatants of the fleet.

Oregon.

In the afternoon of the 26th of June the auxiliary cruiser Oregon, and the gunboat Express, arrived.

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Gunboats. On the 27th the long-expected gunboats Medina, Medway, Snap, and Pike, under convey of the Sea-horse, joined the squadron. They had made a long passage. Owing to the heavy weather and high sea their speed was reduced to three knots, although in smooth water the Sea-horse could tow all four without difficulty at a speed of seven knots. The Medina and Medway were placed at the east entrance, close to the shore ends of the booms. The Snap and Pike were placed at the west entrance, and at the end of the booms.

Hawk. On the 28th of June, being the Queen's Coronation day, nothing was done on the fleet. In the afternoon the coastguard cruiser Hawk, belonging to the division under Admiral Hoskins, was signalled in sight. In reply to a question, "Who was on board?" she replied, "The Correspondent of the *Zeitung*." As a doubt was felt as to the correctness of this answer, the question was repeated. Later the Hawk hoisted the Admiral's flag, and the conjecture was confirmed that Admiral Hoskins was on board for the purpose of reconnoitring.

Mercury. Towards evening the Mercury rejoined the squadron from Devonport, where she had left the Leander. As the Mercury had had no information of the changes in the position of the booms already described, she steamed over the obstructions and received some injury both from the booms and the mines. The Mercury was attached to the attacking division, and immediately left the haven to join the squadron under Admiral Hoskins. Two torpedo boats of the Minotaur were taken prisoners by the black boats which were cruising outside Bere Island.

Commencement of attack. On the 29th of June at 2 P.M. the hostile operations commenced. All the boats of the defensive squadron were manned. Twelve were stationed at the mainland end, and twenty-seven at the Bere Island end of the eastern boom. The marines were on board the boats. The landing party at the east end of Bere Island was under the command of Captain Adeane, and that at the western end under Captain Boyle. At 2 P.M. Rear-Admiral Whyte inspected all the positions and the defences. After 3 P.M. came the report that the Mercury, accompanied by a torpedo boat, was steaming along the shore of Bere Island towards the western entrance to reconnoitre. The Mercury, discovering two of the white torpedo boats belonging to the division under Rear-Admiral Whyte, opened fire; one of the boats was captured and the other sunk. The Mercury sent back her torpedo boat with the report of what had occurred to Admiral Hoskins. This boat was seen and chased by a torpedo boat of the defending squadron. After some time a second white torpedo

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boat came out of a creek, and cut off the retreat of the black torpedo boat. Later, at the risk of being attacked on both sides, the torpedo boat managed to effect her escape, and place herself once more under the protection of the Mercury. Towards 8 P.M. the black flotilla returned to Glengariff. Rear-Admiral Whyte's squadron remained on the alert the whole night, and, in the belief that early in the morning an attack might be made, was prepared for every contingency.

As the moon was setting, towards midnight, a report came from the outer shore of Bere Island that an attack was threatened on the east entrance, and that three ships with the torpedo boats were already in sight. In effect the ships so reported were the Mercury, Cormorant, and Hawk—the latter with Vice-Admiral Hoskins on board. The attacking division consisted of these ships with three first-class and four second-class torpedo boats, four armed launches, five steam pinnaces, two steam cutters, and eight small boats. The boats were distributed into four divisions. The armed launches were to destroy the enemy's electric lights. Under cover of the darkness the torpedo boats of the first class were to endeavour to explode their torpedoes against the booms and to destroy them. The small torpedo boats were to make their way through the breach, and attack the ships anchored for the protection of the booms.

The boats of the attacking division steamed boldly up to the booms, but, as it was ascertained upon a close examination subsequently, without any effective result. Charges of gun-cotton were laid by the steam pinnaces on the booms in five places, but so heavy a fire could be directed by the aid of electric lights from all sides upon the boats, both from the land batteries and the ships, that it is certain none of them could have succeeded in escaping destruction. The Mercury was under the fire of the Hotspur at close range, and according to the rules laid down, she was declared *hors de combat*, and accordingly discontinued her fire, after having sent nine rounds at the booms. The Hotspur also destroyed one of the torpedo boats of the attacking force. The attempt to force an opening through the booms on this side was effectually repulsed.

The attack on the west side took place at about the same time. The Conquest, escorting five first-class torpedo boats and three second-class torpedo boats, doubled, unperceived by the Whitehead boats, the west point of Bere Island, and attempted to get up to the booms. This brought the engagement within the space illuminated by the electric light, and a heavy fire was exchanged between the assailants, and the Rupert, the gunboats Snap and Pike, and the boats stationed

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at the booms. At this point also it was decided that the attack had been repulsed.

At 1.20 A.M. the action was over.

The night attack was a stirring and imposing spectacle. One steam launch jumped the booms, but, instead of immediately endeavouring to make use of her spar-torpedo, she attacked one of the enemy's boats, which were guarding the boom on the inside, and was declared to have been captured. A torpedo, fired from above the water, struck the boom, and, if loaded, would undoubtedly have blown it up. The steamboats, armed with spar-torpedoes and guns, took an active part in the encounter.

General result.

The general result of the operations points to the conclusion that, under the precise conditions under which the attack on Bantry Bay took place, it was impossible to force a passage through the obstructions. An attack in actual war, in bad weather, on a dark night, against a blockaded squadron worn out with constant alarms, is a different question. Further light will be thrown upon the problem by the forthcoming experiments in Black Sod Bay, when an attack will be made upon the fleet, defended by mines and torpedo nets.

The squadron preparing for sea.

On the 30th of June, the ships of Admiral Hoskins rejoined the squadron in Bantry Bay, and preparations for going to sea were commenced.

Polyphemus.

On the morning of the 30th of June, the Polyphemus went outside, with a view to test experimentally the effect of a charge delivered by a ship of her dimensions and type upon the boom. It was assumed that the mines, which had been laid outside the boom, had been moved, but the ship was to defend herself against six torpedo boats. The Polyphemus steamed two miles outside the entrance, and then turned and charged the booms at a speed of 17 knots. She eluded the boats which were pursuing her by manœuvres which were commended by the umpire as admirable and extremely skilful. She succeeded in avoiding the nine or ten torpedoes, which were discharged at her, struck the boom at right angles, and went through it and the 5-inch steel hawser, by which it was secured, as if it were packthread. Not the slightest shock was perceptible on board.

After this a mine was laid across the boom and exploded. The boom was broken up and the wire rope was carried away, but the opening in the boom was still too narrow for a torpedo boat to pass through.

On the 1st of July the spars were again taken on board the ships and all the floating defences were recovered. The spars, with the exception of those which had been carried away in the last experiment of the Polyphemus, were not materially injured.

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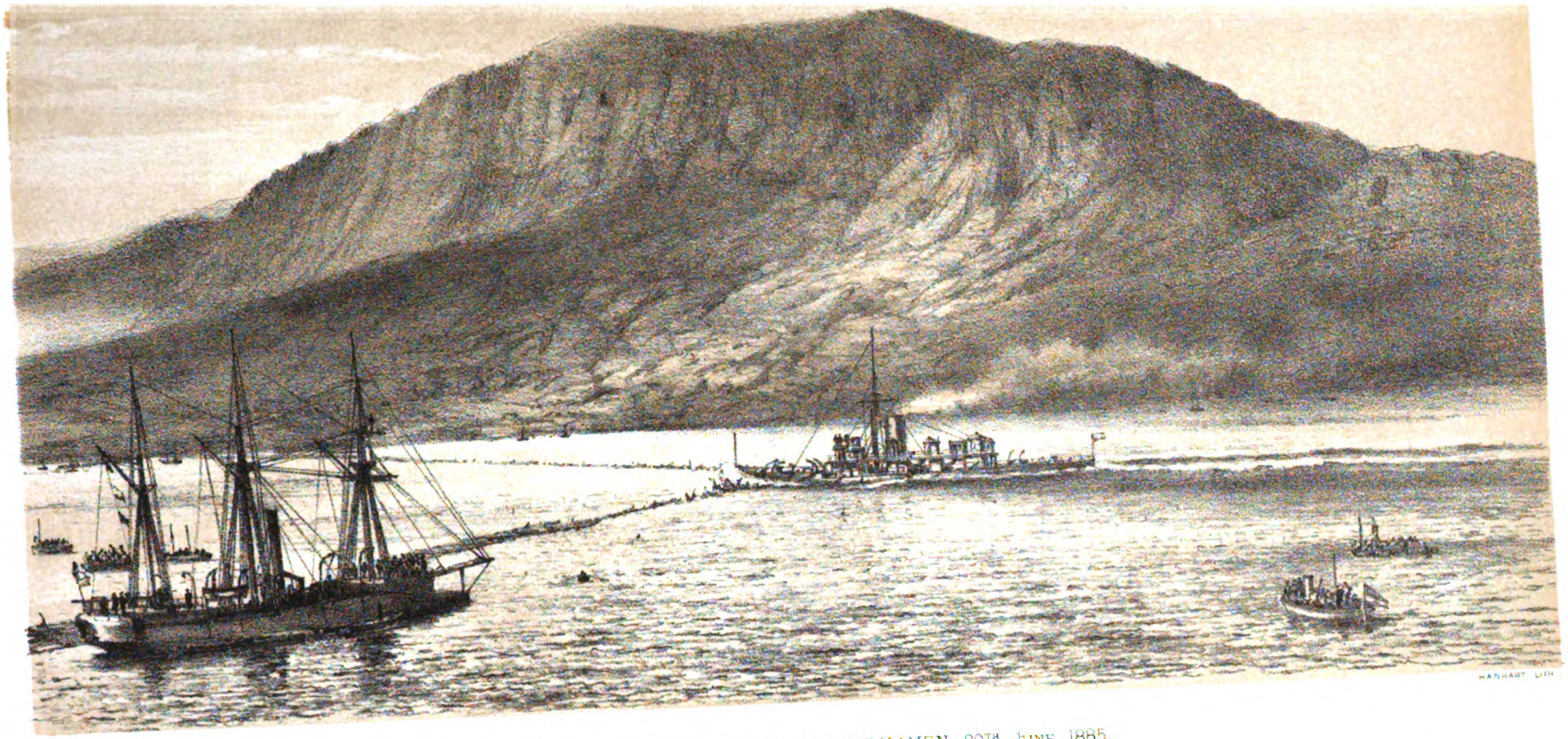

POLYPHEMUS CHARGING BOOM AT BEREHAVEN. 30TH JUNE 1885.

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On the 2nd of July the Hercules left with Vice-Admiral Hoskins. He had been appointod to a seat at the Board of Admiralty, and was to be succeeded in his command by Admiral Heneage. Departure of Hercules.

At 5 P.M. the squadron sailed for Black Sod Bay. The squadron sails for Black Sod Bay.

The formation of the squadron was as follows :—

First Division: Minotaur, Polyphemus, Lord Warden, Rupert, Shannon, Devastation, and Hotspur.

Second Division: Agincourt, Sultan, Penelope, Ajax.

The corvettes and cruisers acted as *éclaireurs*. The gunboats followed, under the convoy of the Sea-horse, and the torpedo boats kept close to the large ships to which, under the original distribution of the fleet, they had been attached.

The experiments and exercises in Bantry Bay formed the first part of the programme. Those which were to follow in Black Sod Bay formed the second part.

At the close of the first series of manœuvres, Admiral Hornby issued to the commanders of the ships a Memorandum, in which he placed before them, for careful consideration and reply, certain questions suggested by the experiences gained during the exercises in Bantry Bay, with regard to the formation and the use of obstructives. Opinions on best means of defence and attack.

It was supposed that the fleet anchored in Berehaven was stronger than the enemy, but yet that a *coup-de-main* from the latter was to be apprehended. It was necessary therefore, to place obstructions quickly for the purposes of defence. They were therefore further to consider in what way a harbour like Berehaven could be best defended. It was to be kept in view that nothing should be done which would hamper the operations of the fleet anchored inside the line of defences.

A division of the fleet consisting of three ironclads, a corvette, and three first-class torpedo boats, was to be in readiness to make a sortie upon the enemy, while a force of 200 marines, with guns, was to be left behind for the defence of the obstructions.

The officers were invited to give their opinions on the following subjects :—

(1.) The general efficiency of the English system of submarine mines.

(2.) The use of gun-cotton for observation mines.

(3.) The value of electric contact mines.

(4.) The efficiency of electric torpedoes, and the most secure means of laying them down and taking them up.

(5.) The advisability of using the same cable both for countermines and electric contact mines.

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(6.) Would a fleet be secure from a night attack by defending itself with torpedo boats, anchored at suitable points, and acting as fixed batteries, and without support from submerged torpedoes?

The other questions included the value of the electric light ashore or afloat and the best means of placing it.

The best system of defence of a fleet by means of mines.

The value of certain special torpedoes.

The best form of boom.

Should the boom be constructed within or outside the line of torpedoes, or should there be two booms?

Assuming the boom to be formed of wood, how are the necessary materials to be obtained and stowed away in a fleet consisting of mastless ships?

Should nets be suspended from the boom, and, if so, how?

What description of guardboats should be used?

How should they be distributed and armed?

How should a well-constructed boom be destroyed?

How should a fleet be moored for defence of a harbour?

Passage to Black Sod.

The squadron, as it has already been stated, left Berehaven on the 2nd of July in the evening, in divisions, and, on leaving, steered to the westward.

On the 3rd of July the weather was unfavourable and rainy. The course steered was to the northward. In the afternoon it became so thick as to make it necessary to make use of steam-whistles to avoid collision.

Arrival at Black Sod.

On the 4th of July the weather cleared a little, and at 4 A.M. land was visible on the starboard hand. The squadron passed Black Rock Lighthouse at 7 A.M. in columns of divisions, rounded Black Sod Point, and anchored in Black Sod Bay.

Torpedo nets.

The torpedo boats lay in Eily Bay, on the east side of Mullet Island, where they had less water and a more sheltered anchorage. In the afternoon all the ships so provided rigged out their torpedo nets.

Bad weather.

On the 5th of July the wind shifted. The weather became stormy, and the gunboats and torpedo boats had a bad time. Although they had steam up, they dragged their anchors and several torpedo boats went ashore. The decks of the torpedo boats were leaky; they rolled so much that it was impossible to do any cooking on board, and the crews, being unable to get any rest, were almost exhausted.

On the 6th of July the entrance to the harbour should have been defended by mines, but the operation was postponed, owing to the bad weather. In the afternoon cables were veered to six shackles and steam raised. In the evening the wind moderated, and on the

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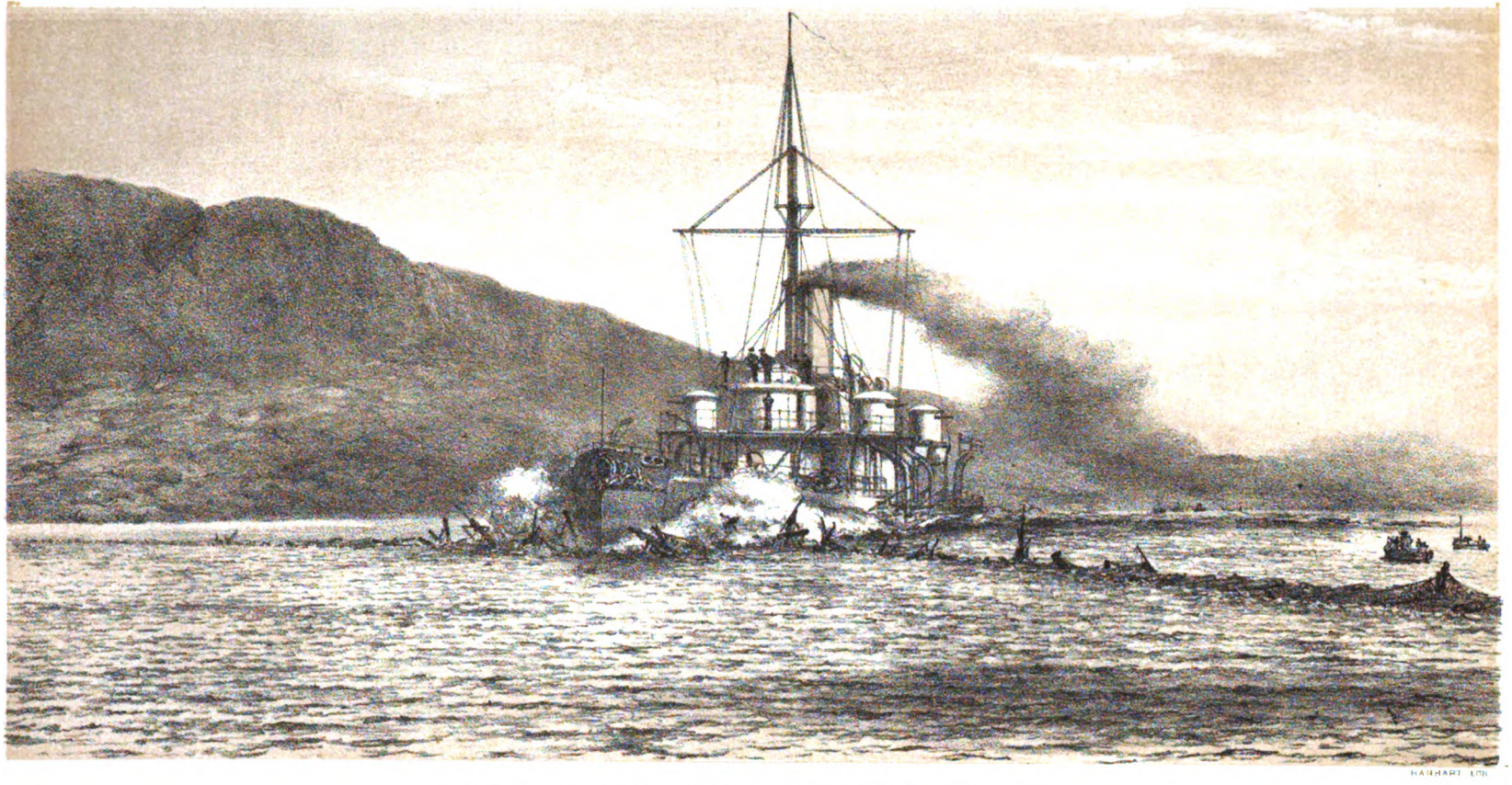

POLYPHEMUS CHARGING BOOM AT BEREHAVEN. 30TH JUNE 1885.

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7th of July the weather was again tolerably fine. In the morning the ships were cleared for action, and from each of the ships which were fitted with torpedo tubes two torpedoes were fired for exercise. A heavy sea was still running, but the opinion that the motion of the sea has no effect on a torpedo with an immersion of ten feet was again confirmed. Later the ships rigged their torpedo nets outboard.

Night attack.

In the night an attack was made by the first-class torpedo boats on all the ships fitted with torpedo nets. The Minotaur, Repulse, Agincourt, and Lord Warden, not being fitted with torpedo nets, took no part in this engagement. The third class torpedo boats, and the steam pinnace from each ship, were told off to act on the defensive. None of the ships attacked made use of the electric lights. The corvettes and gunboats fitted with electric lights were so placed that they were able to surround the ironclads with a bright beam of light. No torpedo boat could get within striking distance of an ironclad without crossing this beam of light. The night was more favourable for an attack than at Berehaven. The sky was cloudy, there was no moon, and the ships which were supposed to have their guns double loaded with case-shot lay in complete darkness. Every light on board was extinguished.

The attack begun at 10.40 P.M. Repeated attempts were made by the torpedo boats to cross the beam of light, but they were always perceived and repulsed by the fire of guns and mitrailleuse. After all the torpedoes had been fired a search was made, and some torpedoes were discovered entangled in the nets of the Hotspur, Repulse, and Ajax. At 12.15 the action was brought to a close by a signal from the flagship. It was clearly proved that every boat engaged in the attack would have been exposed to a destructive fire from the heavy guns, and to a still more effective fire from the light armaments of the ships. In no case did the torpedo force its way through the torpedo nets.

Preparations for sea.

On the 9th of July the torpedo nets were hoisted up and stowed away, a manœuvre which up to this time had always been executed most rapidly by the Shannon. The time occupied in that ship was one hour and forty minutes.

Squadron formed in two divisions.

On the 10th of July, in the afternoon, the squadron was divided into two sections in readiness for their departure from Black Sod Bay.

Departure of Admiral Whyte.

One division, consisting of the Agincourt, Ajax, Penelope, Repulse, Hotspur, and Sultan, with the Oregon acting as a despatch vessel, the corvette Conquest, the composite sloop Cormorant and gun-

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vessel Mariner, the gunboats Medway and Snap, and in addition four first-class torpedo boats, were placed under the command of Admiral Whyte. This squadron left the harbour under sealed orders, and steered for Lough Swilly.

Plan of operations.

The second division, consisting of the Minotaur, Hercules, Shannon, Lord Warden, Devastation, Iron Duke, and Polyphemus, with the Mercury, Sea-horse, Express, and Racer, the gunboats Medina and Pike, the torpedo ship Hecla, and four first-class torpedo boats, remained under the command of Admiral Hornby, and they were to remain in the harbour until nightfall, when they were to leave, with the intention for making for Greenock or Belfast, and to destroy those ports or put them under contribution.

The division under Admiral Whyte was to prevent the execution of this plan. They were to operate from Lough Swilly as a base, and they were to intercept and engage the squadron of Admiral Hornby.

Departure of Admiral Hornby.

Rear-Admiral Whyte retained the Oregon to keep a watch on the proceedings of the enemy, who had remained behind in Black Sod Bay. The night following his departure was stormy, and at the time when Admiral Hornby's division weighed anchor the rain fell in torrents. Admiral Hornby, however, did not succeed in leaving Black Sod Bay unperceived by the Oregon. Having gained an offing, the weather proved so bad that it was necessary for the large ships to take the smaller vessels in tow. The torpedo boats suffered severely; and, on the morning of the 11th of July, the fleet being some fifty miles from the land, it was determined to send the flotilla back to Black Sod Bay under the convoy of the Mercury and the Hecla. Having parted company with the torpedo boats, the fleet steered a north-easterly course for the Scotch coast. The Sea-horse was repainted and disguised and sent forward as a look-out ship. Two strange sail were sighted. They were not recognised, and it was supposed that Rear-Admiral Whyte was not aware of the departure of the squadron. This proved to be an error, as every movement had been reported.

Movements of Admiral Hornby.

The 12th passed away without any signs of the enemy. On the 13th, the fleet reached the Island of Colonsay, and, shortly after, anchored at Schallasaig, where they found the Mercury, Hecla, and torpedo boats, awaiting their arrival. They were further re-inforced by the Iron Duke, which had been left behind at Black Sod Bay for repairs to her machinery.

The weather continued fine, and hopes were entertained of being able to elude the watchfulness of the enemy.

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Admiral Hornby, as had been expected, ordered the attack to be directed against Greenock. At 3 P.M. the ships weighed, and, steering to the south of Islay, arrived on the 14th of July, before daybreak, abreast of the Lighthouse, and again anchored. A torpedo boat was sent forward, and reported that the enemy was not in sight, but a party who had been sent ashore to reconnoitre, and had mounted a hill, reported that the Oregon, Mariner, and a yacht, could be seen cruising out at sea. Admiral Hornby at Islay.

Towards evening Admiral Hornby gave the caution to be ready to weigh at 9.30 P.M., and, shortly after, the division proceeded in two columns, at a speed of 10 knots; steering for the Mull of Cantyre, the Mercury, and torpedo boat No. 22 leading, with the Sea-horse and the Express on the outer flank, and the Racer on the inner flank of the squadron. About an hour after midnight, on the 15th of July, the division was abreast of the Lighthouse on the Mull. The excitement was great, and it was evident that it must soon be decided whether the passage to Greenock was open. At this moment the Minotaur and Hercules were leading the columns. The Polyphemus, Devastation, Lord Warden, Shannon, and Mercury, were following at a short interval. Abreast of the Mull Light the flagship fired a rocket, as a signal that the manœuvre would succeed; and great surprise was felt when immediately two rockets were sent up on the south-west. Off Mull of Cantyre.

These were fired by the Agincourt, which, with two ships of the enemy, was coming slowly up from the direction of Rathlin Island. The enemy was not in a position to prevent Admiral Hornby's advance on Greenock. Being satisfied of this, Admiral Hornby ordered the attack to be directed on Belfast instead of Greenock.

The failure of Admiral Whyte was due, not to any neglect to keep a good look-out, but to the unsatisfactory speed of the ships under his command. His plans for obtaining intelligence of the movements of his opponents were exceedingly well conceived.

In the evening of the 15th of July almost all the ships were assembled off Carrickfergus in Belfast Lough.

It was decided that Admiral Hornby had succeeded in forcing his way up to Greenock, but that the enemy's fleet had been so close upon his heels that he had had no time to take measures for providing himself with defences, or for closing the passage up the Clyde. It was therefore doubtful which of the two squadrons had gained the advantage.

On the 16th of July, between 1 and 4 P.M., the squadron left the anchorage of Carrickfergus and steered for Portland, from which place it had originally set out.

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Foreign criticisms.

The exercises carried out under Admiral Hornby excited a deep interest in foreign navies.

Some French periodicals discussed with a critical spirit the proceedings as an imperfect imitation of what might actually happen in war. It is obvious that the circumstances cannot be exactly reproduced. It was, however, admitted that the experiments in the use of the torpedo and in the means available for defending ships against that new and formidable weapon, were extremely instructive. The efficiency of the nets as a means of defence against the torpedo, especially in the otherwise dangerous position in which the fleet would be placed in a close anchorage, was fully recognized. The officers of the fleet were loud in their praise of the ability displayed by the Admiral in command, and a naval correspondent, writing to the 'United Service Gazette,' calls attention, and justly so, to the ability displayed by Staff-Commander Phillips of the flagship for the earnest skill and pains he had displayed in the cruising of the fleet on the darkest nights and through the most intricate and difficult navigation.

Having accompanied the Evolutionary Squadron on its interesting cruise, the compiler addressed the letters which follow to the *Times*:—

'TIMES,' JULY 18, 1885.

Letter to the *Times*, July 18, 1885.

The following notes, as giving the results of personal observation during a recent cruise with the Evolutionary Squadron, may not be without interest for the public.

It would, perhaps, be unbecoming in a civilian to criticise the *personnel* of the fleet. Captains of great experience express the highest satisfaction with the crews under their command; and, if I may add an independent testimony, it will be to the effect that it is impossible not to feel deeply impressed with the zealous spirit and devotion to duty displayed by all ranks throughout the squadron.

Avoiding all questions of individual efficiency, I turn to the general subject of the training of the Navy. It is evident that the system which has given us the fine body of men who form the crews of the Evolutionary Squadron is likely to undergo a considerable change. Exercises aloft have hitherto filled a large part of the seaman's life. The limited amount of time devoted to the handling of canvas during the cruise under Admiral Hornby affords an unmistakable indication that instructions having a more practical bearing on naval warfare in these days of steam are taking the

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place of sail-drill, and the shifting of masts and yards. Is it, therefore, to be assumed that the art of seamanship, as formerly practised, is to be neglected by the Navy of the future? Should not the aim be rather to combine all that was valuable in the former system of training with the gunnery and torpedo exercises which are now indispensable? Every officer and man should be familiar with the ships in which he may be called upon to do battle for his country. But if the sailor remains too long in a mastless ship he will lose in general smartness and agility. His life will become too monotonous and confined. These observations seem to point to alternate periods of service in the masted and mastless ironclads—the winter months in the masted ships, cruising to the southward, the summer months being spent in the newest ships in home waters, and devoted to the system of instruction now being inaugurated in the Evolutionary, or, as it is sometimes called, the "Revolutionary" Squadron.

The exercises and operations of the squadron have already been graphically described by the correspondents of the Press. There are, however, one or two incidents which it is difficult for an eye-witness to pass by in silence.

The attack on the boom at Berehaven by the Polyphemus was a grand experiment. The Polyphemus prepared for the final charge by steaming round Bantry Bay, gradually attaining the extreme speed of nearly eighteen knots. Then, like some bird of prey, which first circles in the air and then sweeps down upon its victim with an overwhelming blow, the ship was suddenly steadied in her course, steered straight for the boom, and, cleverly eluding four out of five torpedoes, swept through spars and steel hawsers without even a momentary check. The experiment was watched with breathless interest, and its triumphant success filled with admiration all who witnessed the stirring scene. It was not merely magnificent as a spectacle, but it must have an important bearing on the practical question of the defence of fleets in close harbours.

The imposing appearance of the squadron at sea equally demands a few words of description. On Thursday, the 2nd of July, in the evening, the squadron weighed from the anchorage at Berehaven. As soon as he had gained the open waters, the Commander-in-Chief, by a clever manœuvre, brought his flagship and the line which he was leading nearest to the dangers of the coast. When the squadron was finally formed in the order prescribed by the Admiral, the Oregon was the leading ship. The station of that noble specimen of the American liners was far away in the van of the squadron. On either quarter of the Oregon were the heavy ironclads, led in two

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lines by their respective Admirals. The flanks were covered by the look-out ships, their station being kept with great precision. The majestic procession, moving rapidly onward in perfect order, produced an effect far surpassing the most brilliant naval review.

I now turn to matters which more directly concern those recently responsible for the administration of the Navy. Have we, or have we not, succeeded in putting into the hands of our gallant and skilful seamen a satisfactory *matériel?* This is for us and for the country a question of the first importance. The new problems connected with torpedo warfare were the special occasion for the assembling of the Evolutionary Squadron, and it will be to the torpedo flotilla that I shall chiefly refer.

The experiences gained in the recent cruise have thrown considerable light on the direction which should be given to the construction of the future. Three classes of torpedo vessels seem to be required for the Navy.

1. The largest class should be capable of making a direct attack on ironclads, in open day, with a fair chance of success. This class is represented in the squadron under Admiral Hornby by the Polyphemus. In speed and fighting power—whether with the ram, the torpedo, or machine and quick-firing guns—the pioneer vessel of this type may be pronounced a success. The quality which is deficient, to borrow a French term, is that of habitability. In a war with a serious foe our squadrons might be required to keep the seas for more extended periods than under the easy circumstances of peace. It would be in long cruises that the defects of the Polyphemus would make themselves felt. Even in favourable weather the ordinary swell of the Atlantic breaks on the deck, as upon a half-tide rock, compelling the crew to remain below. Close and constant confinement under hatches would lead to a rapid deterioration in the physical condition of the men. The one capital defect of the Polyphemus would be remedied by building up amidships a superstructure of moderate height. Such a superstructure would contain a well-lighted and well-ventilated lower deck, and carry a dry and spacious upper deck, available for drill and exercise in all usual conditions of weather. The plans for an armoured ram, now under consideration at the Admiralty, provide for a considerable increase of freeboard as compared with the Polyphemus. Nothing would be lost either in invisibility or invulnerability in the improved design. In the Polyphemus the flying deck and turrets are conspicuous objects. A superstructure not intended to be occupied in action might be riddled through and through without injury to the fighting

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efficiency of the ship. The improved Polyphemus may be taken to represent the most powerful type in the torpedo flotilla of the near future. It is satisfactory to find that we have so nearly reached an ideal perfection in the first design produced at the Admiralty.

2. The smaller type required to keep company with a squadron—the type shortly to be represented in the French Navy by the eight vessels of the 'Bombe' class—we have as yet only in miniature in our first-class torpedo boats of the most recent pattern. These latter are vessels of some 60 tons. Enlarged in dimensions, and, except as to dimensions, with no essential modifications of design, we may accept them as excellent models for a larger class, of perhaps 300 tons, and a still larger class of 600 tons. The best dimensions for a sea-keeping vessel can only be determined by experiment.

Looking to the great importance of numbers, it would have been satisfactory to have rested content with the dimensions within which our constructors have hitherto been called upon to work. The reasons for an increase of size in the sea-going torpedo vessels of the smaller class are identical with those which apply in the largest class of the torpedo flotilla. Battened down, the present boats may be safe in any weather, but the crews, confined below and exposed to the heat of the engine-room, would soon become unfit for duty. The situation of the officers and look-outs on deck would be scarcely less intolerable. The low decks would be swept by a blinding spray, and by volumes of solid water, from which no adequate protection could be provided.

Hitherto, although the squadron has escaped bad weather at sea, the crews have suffered many discomforts, which have been borne without a murmur both by officers and men. It is no light ordeal to be translated suddenly into a torpedo boat on the Atlantic after a year of close study in the Excellent, the Vernon, or the college at Greenwich. A man must be versatile, indeed, both physically and mentally, to adapt himself to the wide and constant changes to which officers of the Navy are subjected. It is scarcely less trying for the seamen to serve to-day in the Minotaur and to-morrow in a torpedo boat.

3. In addition to the sea-going vessels, the torpedo flotilla of our squadrons should include a number of boats of the largest dimensions which it is practicable to convey from point to point in the torpedo-boat carriers, and the floating steam factories—the Heclas and the Oregons—which have now become a necessary feature in the fleets of modern days. The smaller torpedo boats are especially suitable for harbour operations.

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Our present second-class torpedo boats, somewhat enlarged, are satisfactory in all essential points. The first-class torpedo boats attached to the Evolutionary Squadron do not fall within either of the three categories which seem to be required for a sea-going squadron. But they are thoroughly efficient for coast and harbour defence, and it was for that duty that they were designed. The existing first-class boats and the large number of a yet more powerful class, now being rapidly constructed from funds provided under the Vote of Credit, will supply an excellent defensive flotilla for our seaports at home and abroad. In the Clyde and the Forth, in those numerous and intricate channels between banks of sand and mud at the entrances to the Mersey, the Thames, the Humber, and in the Bristol Channel; or abroad in the Straits of Gibraltar, in the Malta Channel, in the Straits of Bab-el-Mandeb, in the Straits of Malacca—in short, at all important naval and commercial stations —our torpedo boats built and building will be most valuable.

The cruise of the Evolutionary Squadron round the west coast of Ireland has been an heroic effort—a *tour de force* for harbour and coast-defence boats. But, handled as they have been with skill and judgment, the boats have come out of the trial at least as well as might have been expected. Admiral Hornby attached each of the torpedo boats to an ironclad, which served as a floating breakwater to her fragile attendant. From the poop of the Minotaur I had an opportunity of observing the behaviour of the torpedo boat attached to that vessel. Nothing could have been more easy and graceful than the movements of the slender craft as she rose and fell with the easy motion of a bird skimming the surface of the sea. To compare it to the flight of a flying fish is the best illustration that I can give. After admiring this grace of movement, a striking impression was conveyed of warlike fitness and power, when, instantly, upon any signal from the flagship, the torpedo boat dashed away from under her quarter at a speed of 17 knots, to convey a message or an order to the furthest vessels in the wide extending squadron. In the smoke and confusion of battle the same lightning speed and agility of movement would give to the torpedo boat a terrible power in the use of a deadly weapon.

The efficacy of the means of defending a fleet by booms in a close harbour, and by nets and guardboats in an open anchorage, has been fully tested in the Evolutionary Squadron; and the defence may probably be considered to have been successful. It will be admitted, on the other hand, that the attacks by the torpedo boats have not been made under such circumstances as an enemy would

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select. The nights have been clear and the ships have been able to use all the means at their disposal for repelling an attack. The torpedo boat will certainly prove formidable to a blockading fleet at night, or in foggy weather.

In a further communication I propose, with your permission, to deal briefly with the armoured and unarmoured ships.

'TIMES,' JULY 25, 1885.

Further Letter to the *Times*, July 25, 1885.

Having dealt in a former letter with the torpedo-flotilla—the most novel and interesting feature in the Evolutionary Squadron—ships of more familiar types will form the subject of the present communication.

The introduction of armour has changed their sphere of action, but unarmoured vessels still continue an indispensable element in our fleet and squadrons. They are the look-out ships, and are equally essential whether in the blockade of an enemy's port or in warfare on the open sea. For all the duties that most appropriately devolve on the steam cruisers—the frigates of the present day—speed should be a paramount consideration. The advantage of superior speed was brought out in a conspicuous manner in Bantry Bay. When the torpedo boats of the defensive force sallied forth to drive off the blockading squadron, the Mercury with ease kept ahead of her assailants, and could have destroyed them with the fire of her guns. In the case of all the other unarmoured vessels, the torpedo boats could have closed with them so rapidly that they might have succeeded in coming up within striking distance without receiving fatal injury from gun-fire.

The insufficiency of speed in the great majority of our unarmoured classes is principally due to want of length. Until a recent period a superiority in armament over foreign ships of the same tonnage, good steering qualities under steam, and handiness under sail, were demands urgently pressed upon the constructors of the Navy. These qualities are secured most easily in short ships, and forms were adopted by no means favourable to speed. By the brute force of powerful engines results were obtained at the measured mile which were considered satisfactory. But the same results were not maintained at sea, because the conditions under which the measured-mile trials are conducted can never be secured in practice. At the measured mile the sea is always smooth; on the ocean it is never so. The altered conditions tell most strongly against ships deficient in length,

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especially when contending with a head sea. The long vessel, on a comparatively even keel, holds her way in the manner so remarkably illustrated in the fast and regular passages of the American liners. The short vessel, falling into the trough of the sea, rapidly loses the speed attained in smooth water. In the latest designs for unarmoured ships the proportions leave little to be desired. But the vessels attached to the Evolutionary Squadron, although of recent date and exhibiting a decided progress over their immediate predecessors, are deficient in respect to length. Even the Mercury would be improved by the addition of forty feet. The other unarmoured vessels of the fleet include the Conquest, the representative of the large and costly C class, ships of 2380 tons, and ten in number; the Cormorant, the representative of the Bird class, also ten in number, and measuring 1130 tons; and the Mariner and Racer, the most recent type of small unarmoured vessels yet afloat. As to all these vessels, it must be admitted that they are too short and too slow for fighting operations in which torpedo boats could take a prominent part. For the same reason they are less capable than we could wish of giving effective protection to commerce. They would require the whole day and smooth water to catch a collier, sighted on the horizon at daylight. It is difficult to over-estimate the gain in the efficiency of the Evolutionary Squadron from the addition of a few more ships equal in speed to the Polyphemus or the Mercury; but even the Mercury is not adapted for steaming against a head sea. She requires a light covering-deck fore and aft, with no bulwarks to hold the sea. She only carries three and a half days' coal. It is highly satisfactory that we have in various stages of construction the four Leanders—all now nearly ready for sea—four Merseys, and five belted cruisers. All these ships should be even more capable than the Mercury of doing the work which that vessel has performed so well in the hands of an accomplished seaman during the present cruise. While so much inferior to the demands of actual war, the Conquest, Cormorant, Mariner, and Racer are all excellent for the ordinary work of the Navy in time of peace. For instruction, training, and the police of the seas we could have nothing better.

Turning from the unarmoured to the armoured ships, the majority of those assembled in the squadron are of early types. In the older ironclads the want of internal sub-division is, perhaps, the most serious structural defect. The torpedo has rendered it more than ever important to localise injuries below the water line.

In speed and coal endurance, no less than in point of internal

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sub-division, the older ships are far behind the latest designs. The insufficiency of coal endurance could be remedied by compounding the engines; and great qualities of speed are not necessary in all ships. It is probable that fleet actions will be brought on by the fast ships on both sides, and fought out, when the hostile fleets have fairly closed, at moderate rates of speed.

Having referred to their admitted defects, the points of superiority of the older ships over the sea-going monitors which have succeeded them are not unworthy of notice. They have been brought prominently into view during the cruise of the Evolutionary Squadron. Steaming to the westward, from Berehaven, on a summer's night, the foredeck of the Devastation was swept by sheets of foam, while the upper decks of the broadside ships were towering high above the waves. That the turret-ship of low free-board is the most powerful type for battle will not be disputed; but the life on board, in an extended cruise, would be wretched.

In the new ships of the Admiral class a great improvement has been effected. We have in the heavily-armoured turrets the fighting power of the Dreadnought and Devastation; while in the battery between the turrets and the lofty and spacious deck above the battery we have the means of carrying a powerful minor armament and placing the crews under the conditions essential to health and efficiency in a sea-keeping ship.

It is not necessary to enter into the question of extended belts of armour at the water-line. As, however, allusion has been made to the defects of the older ironclads, it may not inappropriately be observed that, if the excessive contraction of the armour in our latest ships is open to criticism, in this particular, at least, the older ships have conspicuous advantages: while their inferiority as regards armament is not so clearly established as the pessimists would lead us to believe. It is not impossible that in an action with ships armoured on the system in vogue in France—a system of narrow belts on the water-line and high top sides, undefended by armour—many guns of comparatively light calibre would be found more effective than guns of much greater power, but proportionately reduced in numbers. These remarks seem not uncalled for, in view of the sweeping condemnation which critics, and especially naval critics, are perhaps too ready to pronounce upon ships built at considerable cost, and which were highly approved when they were laid down. The old-fashioned ironclads of our Channel and Reserve Squadrons, strongly built, still in thoroughly sound condition, and so noble in appearance, are not lightly to be put aside as obsolete relics of a

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former age of construction. Their hulls and machinery could be modernised without difficulty if it were thought desirable to take the work in hand. In estimating the strength of the Navy, the means we possess of adapting the ships under consideration to modern requirements should not be overlooked, although the policy of a large expenditure for such a purpose is not likely to find favour. The new Board of Admiralty have acceded to office at a time when public opinion is favourable to a liberal expenditure upon the Navy; but even for the present Board, no less than for those who have preceded them in office, it must often be difficult to decide between expenditure on alterations, and expenditure on new construction. In most cases the balance of argument will incline rather towards the construction of new than to the alteration of old ships.

The Ajax is the latest ironclad in the squadron. The steering qualities are certainly unsatisfactory. In all other respects this ship may be pronounced a success. The cause of the difficulty in steering is patent. The lines of the Ajax are too full. The remedy is a mere question of expense. The run should be lengthened by building on to the ship a false stern. The rudder would thus be removed to a greater distance from the body of the ship, and would no longer work, as now, in dead water. Looking to the great power and efficiency of the Ajax in armament, armour, machinery, and general equipment, this alteration seems worth carrying out.

After every allowance has been made for defects, resulting inevitably from constant changes in the methods and weapons of naval warfare, the Evolutionary Squadron has presented a display of forces which would command the respect of the most captious critics if it had been marshalled under the flag of any other Power. It is easy to criticise this or that ship as obsolete, but let us ask ourselves whether there is any reasonable probability that we can again settle down into stereotyped forms of construction, such as had been adhered to for many years previous to the introduction of armour. Administrators and taxpayers may, indeed, abandon the task of building up a Navy as hopeless if, upon every change of armament and armour, all ships of a preceding type are to be condemned as useless. Let us refuse to give countenance to such a view. While sympathising fully with the anxious desire of naval officers for perfection, let us impartially compare the criticisms passed by British officers upon British ships with those passed by foreign officers on foreign ships. Let us compare the Evolutionary Squadron with the most powerful squadrons that could be brought together under any other flag. How many Devastations, how many ships like the Poly-

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phemus, are ready for sea elsewhere? In every foreign navy, do not the majority of the ships of necessity belong to types more or less out of date? The better opinion would seem to be that the construction of ironclads has been carried forward for the British Navy with not inadequate energy; and that we most need reinforcement in the lighter ships, which are the indispensable auxiliaries of the fleet.

The presence of an armed mercantile cruiser with a squadron of our ships of war should not be altogether unnoticed. The Oregon represented a force in reserve, practically without limit, and which, so long as peace is preserved, imposes no burdens upon the taxpayer. As compared with any cruiser such as we have hitherto constructed for the Navy, the Oregon possesses certain points of superiority of incontestable value. She has a sea speed of 18 knots, a speed not yet reached in the blue water, and maintained through a long voyage, by any ship of war. She combines with this speed an advantage even more conspicuous in point of coal endurance. We have in these two qualities elements of great efficiency for all the duties which probably belong to a look-out ship. As a floating steam factory, or a torpedo boat carrier, or as an escort to a flotilla of torpedo boats, the Oregon could scarcely be surpassed. It is specially to be observed that no ship can be considered a satisfactory escort for torpedo boats unless equal to them in their distinctive quality of speed. A vessel which cannot steam more than 12 knots, must hamper, rather than assist, the movements of boats capable of steaming with ease 18 knots, and which, as it has been found by experience, cannot be handled successfully in a seaway, unless a high rate of speed is maintained. Considered with reference to the purposes of war, the extreme length and want of internal sub-divisions are the most serious defects of the Oregon, as of all the great ocean steamers of the mercantile marine.* In vessels built for commercial purposes the main proportions of the hull must obviously be determined with regard to economy of steam power and the stowage of cargo, rather than the requirements of war; but in their internal structure much might be done at a comparatively small expense to fit them for service as cruisers. In this connection I may specially refer to the introduction of frames designed with a view to constructing, should the necessity arise, additional longitudinal and transverse bulkheads.

Serious objections may be raised to the payment of annual subsidies, but the structural modifications to which I refer, if introduced as part of the original design, would cost comparatively little. The expense should be borne by the Admiralty, but it is unnecessary to

* This criticism has been confirmed by the subsequent loss of the ship.

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add that the proposal is limited in its application to the case of vessels which shipowners are proposing to build of exceptional speed.

In the Evolutionary Squadron, for the first time as I believe since the establishment of the Naval Reserve, officers of that service were invited to volunteer for duty in the Navy. The satisfactory results of the experiment must have an important bearing on the numbers required in the several ranks of the regular Navy. In time of war the demand for lieutenants could not be supplied from the list as at present authorized, and looking to the difficulty of giving employment and promotion in time of peace to an increased number, we may well hesitate to entertain any large proposals in that sense. In these circumstances, the Admiralty may wisely turn their attention to the officers of the Naval Reserve, and in proportion as they recognise the value of their services, the policy must commend itself of giving more ample facilities for training in gunnery and torpedo warfare. We have a school of training at Aldershot for the Reserve officers of the Army; we should make similar provision at Portsmouth for the Reserve of the Navy.

I would refer, in conclusion, to the gratifying testimony accorded by all ranks in the Evolutionary Squadron to the professional abilities of the distinguished officer in command.

To a member of the Board which despatched the squadron to sea, it could not but be satisfactory to learn from the younger officers how greatly they valued the opportunity afforded to them of extending their professional knowledge. For the training of the Navy it would certainly be desirable that once in every year the Channel and Reserve Squadrons should be brought together for exercises similar to those lately carried out with conspicuous and gratifying success.

A yearly repetition of the evolutions would be invaluable to the Navy as a means of gaining experience in naval tactics and in the exercise of torpedoes offensively and defensively. The operations brought out the essential importance of speed. The Mercury, from her high speed, was an invaluable addition to the fleet, and the efficiency of the vessels of the Mariner and Racer class would have been immensely increased by an addition of two or three knots an hour to their speed. By her speed alone the Oregon contributed materially to the general efficiency of the squadron.

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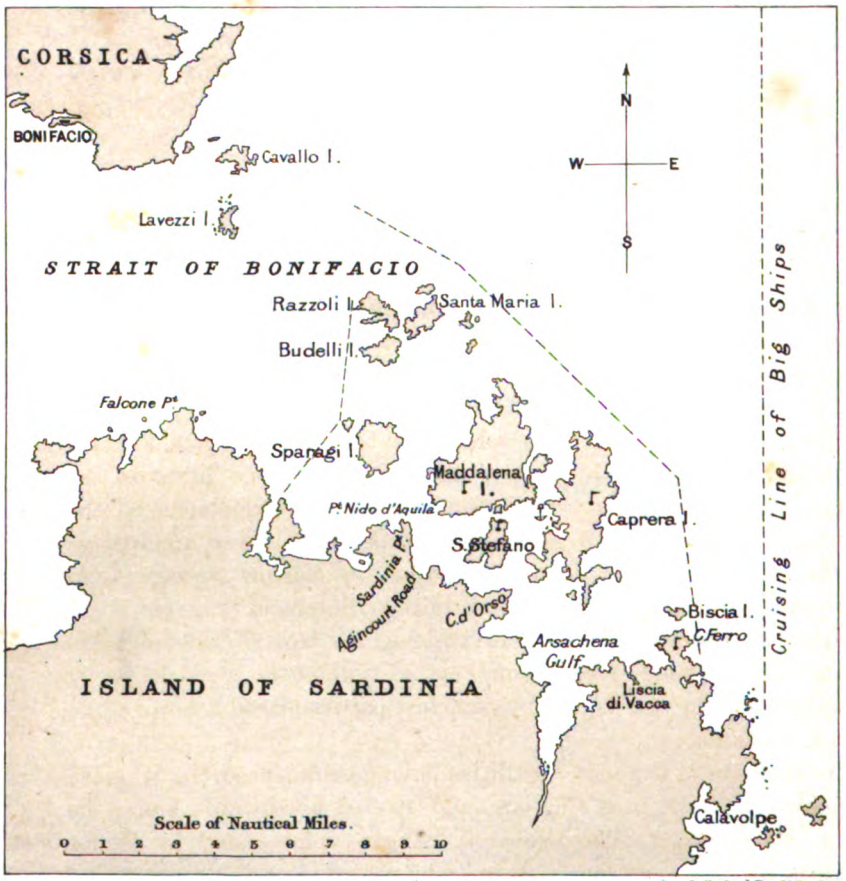
CHART OF A PART OF THE NORTH EAST COAST OF SARDINIA

Explanatory of the Manœuvres of the Italian Squadron in 1885.



Stanfords, Geog.l Estab.t London.

Line of observation of the Torpedo Boats of the Squadron of the West.

Anchorage of the Squadron of the East.

Signal Stations " "

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II.—Evolutions of the Italian Navy, 1885.

In the last fortnight of October, 1885, a series of manœuvres on an extensive scale was carried out by the Italian squadron. The supervision of the manœuvres was entrusted to Vice-Admiral San Bon. Manœuvres of Italian Squadron.

The force under his command was distributed as follows :— List of ships.

Eastern Squadron.—Ironclads, Principe Amadeo (Rear-Admiral Civita), Castelfidardo; cruiser Amerigo Vespucci; sloop Vedetta; and four coast-defence torpedo vessels.

Western Squadron (*First Division*).—Ironclads, Dandolo (Vice-Admiral Martini), Duilio; cruiser Giovanni Bausan; sloop Colonna.

Second Division.—Ironclads, Roma (Rear-Admiral Bertelli), Affondatore; steam watering-vessel Verde, and five torpedo boats.

The scheme of operations was as follows : War having been declared the Western Squadron was to proceed in chase of a squadron represented by the Eastern division of the fleet, which, being inferior in strength, was to seek refuge in one of the anchorages on the north of Sardinia. The assailants were to endeavour to destroy the enemy. The defending force was to endeavour to force the line of blockade and proceed to sea. Plan of operations.

The scene of operations was selected in the group of islands which extends along the north coast of Sardinia from Cape Ferro to the Vezzi Islands off the coast of Corsica. In the position selected the islands of Razzoli, Budelli, Madalena, and Caprera form an archipelago divided from the north coast of Sardinia by narrow passages, and facing the eastern entrance to the Straits of Bonifacio. Scene of operations.

From the fine anchorage of Madalena, the base of the defensive operations, the eastern squadron kept a vigilant look out, both by means of torpedo vessels and by detached parties placed ashore on the adjacent islands.

On the 15th of October, hostilities having commenced, the Western Squadron weighed from Cagliari, and steered northwards along the coast of Sardinia. The Giovanni Bausan, commanded by Prince Thomas of Savoy, and the sloop Colonna acted as look-out ships. The torpedo boats were towed by the ironclads. Commencement of hostilities.

Having reached the island of Tavolara on the 17th, before daybreak, the squadron steered for the Biscia Channel, between the island of that name and Cape Ferro, cast off the torpedo boats, and sent forward its two look-out ships, whilst several vessels were detached to the Gulf of Marianello, to cut the telegraph cable connecting Sardinia with Italy.

At daybreak the Bausan signalled that two torpedo vessels of the

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enemy had been discovered by means of the electric light, and were apparently seeking to reconnoitre the strength of the squadron. The Colonna perceived these boats at a distance of about a mile, and immediately beat a retreat, but it was supposed that the torpedo boats would have remained certainly a full quarter of an hour under the fire of the quick-firing guns, before getting sufficiently close to fire their torpedoes. The torpedo boats also beat a hasty retreat for their anchorage, passing by the Biscia Channel.

Dispositions of the attacking force.

At the same time, the division, which had been anchored for fifteen days under the island of Madalena, was informed by its signalling parties of the arrival of the enemy. Before attempting the attack, the assailing squadron deemed it useful to seize a base of operations; and for this purpose selected Port Liscia di Vacca, situated a little to the west of Cape Ferro and very near the line of defence of the enemy. Before entering this port the Admiral lowered the second class torpedo boats of the Duilio, and the steamboats, with a view to exploring the coasts, forming a line of look-out vessels, and keeping a close watch on the movements of the enemy. At night a vigilant look-out was kept. A flotilla of torpedo boats of the first class was placed at the western end of the estuary of the Madalena; another flotilla between the Razzoli Islands and Caprera. The torpedo boats of the Duilio watched the channel between Caprera and the Island of Biscia. The sea was comparatively calm. Further out, at the western entrance of the Straits of Bonifacio, the Duilio and Affondatore were stationed; and at the eastern entrance the Dandolo and the Bausan. The Roma remained south of Cape Ferro at Cape Volpe, to protect the gear belonging to the boats and to prepare two expeditions, to be escorted by the Colonna, when night had closed in, the object of which was to reconnoitre with care the line of obstructions and defences prepared by the Eastern Squadron. The first of these flotillas returned at daylight; the other had fallen into the hands of the enemy. The former had brought back useful information as to the position of the enemy and his defences. The Biscia Channel and the Channel dividing Caprera from the coast were not obstructed by submarine mines; the squadron might therefore advance without risk and anchor in Liscia de Vacca.

Proceedings on the 19th of October.

At daylight on the 19th of October the movement took place; the Roma, Bausan, and Affondatore were in line ahead, covered by the Dandolo, which was held in readiness to ward off any attack.

Happily for the assailing squadron, the blockaded ships had but few torpedo vessels at their disposal, and as the ships were not provided with torpedo nets, the torpedo boats were necessary to protect

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the fleet in its anchorage. The weather, which had been fine since the commencement of the operations, became stormy on the 19th. The wind sprang up from the south-west accompanied by heavy squalls, but this did not prevent the boats and torpedo vessels of the Western Squadron proceeding at night to attempt to force the blockade of Madalena. They were, however, compelled by the bad weather to abandon the attempt when they had advanced to within the distance of a mile from the enemy. The same thing happened next day. The attempts made to surprise the enemy to the eastward were equally unsuccessful. According to the decision of the umpires, several of the torpedo boats and steamboats would have been destroyed or captured.

In the direction of San Stefano the blockading force was not inactive, and by means of a stratagem the Castelfidardo was sunk. Captain Mirabello had seized a fishing-boat, had placed on board two torpedo men disguised as fishermen, and fixed in a very ingenious manner a torpedo on board. He then sent the boat with the two men into Madalena Bay, where, during the whole day, they were apparently following the employment of simple fishermen. At night they approached the squadron, and, without exciting any alarm, got within striking distance of the Principe Amadeo; they fired a shot at her unsuccessfully, and then proceeding fired a torpedo at the Castelfidardo, and succeeded in blowing her up.

It is certain that in time of war a stratagem of this kind would not be equally successful, but it is evident that the most minute precautions will be necessary to guard against similar attempts on the part of an intelligent enemy full of resources.

Arrangements for the attack.

The situation of the two hostile forces had undergone considerable change. The blockaded squadron had lost one large vessel; while on the side of the assailants most of the torpedo boats had been destroyed. It thus became necessary to attempt some decisive movement. The Admiral in command of the Western Squadron thereupon decided to capture the blockaded ships, and to attack them with his heavy vessels. Knowing that the enemy was protected by a line of torpedoes, he made the following arrangements: The water vessel Verde was to be sacrificed in order to open the passage to the ironclads; and, in order to disguise the vessel, the Verde was fitted with spars and defences, so as to give her the appearance of a large ship, which at night would be undoubtedly taken for an ironclad. The Verde, leading the column, would be blown up by the torpedoes at the point chosen for forcing the line of defence, and thus a passage would be opened for the large ships.

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The Dandolo and the Duilio would support the movement with the fire of their guns, and would follow in line ahead.

These plans were frustrated by the fortune of war. While the Western Squadron was preparing to put this plan into execution, the blockaded squadron was about to make an attempt to force a passage to sea. In effect, at ten o'clock in the evening, at the time when the Verde was about to weigh, the Vedetta, belonging to the blockaded squadron, escorted by three torpedo boats, and followed by the Principe Amadeo, was entering the channel with a view to pass between the Point of Sardinia and the Nido d'Aquila. It was dark, and the wind was blowing strong; when suddenly the squadron was perceived by a torpedo boat, but, as the boat was within range of the machine guns, it was considered to have been placed *hors de combat*. A few minutes later, the Amadeo, steering west at full speed, was sighted by the look-out men of the Duilio. The latter opened fire at 2000 yards, and compelled the adversary to haul down his flag.

Shortly afterwards the same fate befell the Vedetta. The results as regards the torpedo boats of the Madalena division were considered to be undecided. The umpires could not pronounce an opinion as to whether they would have been able to fire their torpedoes before they were sunk.

General results.

It is evident that these manœuvres do not throw much light upon the greater number of the questions which are now engaging the officers of all navies. The Italians are of opinion that they had not sufficient cruisers or torpedo boats, and they regret that they were unable to make any experiments with torpedo nets. But the exercises had their value. The plans carried into execution show that it was desired to realize as much as possible the actual conditions of naval war. It is impossible, without having taken part in the operations, to pronounce an opinion as to the skill with which the vessels were handled. All that can be said is that the ships sustained no injury. The operations took place at night in strong winds and a high sea, exactly as it might be in the presence of the enemy; no lights were shown, and the service of umpires seems to have been established with perfect success. It appears, nevertheless that the attacking squadron made no attempt to protect its base of operations by means of a line of booms at least sufficient to keep off torpedo boats. It is also evident that an ironclad fleet blockaded by a very superior force in a roadstead like that of Madalena is exposed to imminent risk of destruction by a dashing enemy. It is not clear why the commander of the Eastern Squadron

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did not profit by the obscurity of the night and the bad weather to send his torpedo vessels against the enemy's ships, unprotected as they were either by booms or nets.

III.—Exercises of the Austrian Fleet. 1885.

(From the *United Service Gazette*, 25th July, 1885.)

The exercises of the Austrian fleet in the Adriatic, which took place at the end of June, 1885, are described briefly in the following paragraph:—

La Progrès Militaire thus describes the manœuvres of the Austrian fleet in the Adriatic, which took place at the end of June:—"The following was the plan of the operations: A flotilla of torpedo boats cruising in the waters of Zara is informed by the semaphore at Lissa that an enemy's fleet has passed within sight in the morning. The torpedo fleet sets out at once, with the object of either destroying the enemy or of so damaging him as to force him to retreat. The enemy was represented by the ironclad fleet, under the command of Vice-Admiral Sterneck. It arrived by the passage of Bucci, sailing in double columns. It continued its course as far as the lighthouse of Punta-Rianca, on the island of Grossa, and when night came on set its electric machines at work, sweeping the sea with eight great luminous cones, so as to disclose the torpedo fleet whose approach it suspected. At half-past nine a cannon-shot from the admiral's flagship, the Lissa, announced that the first torpedo boats had been discerned. In a few minutes the whole squadron of torpedo boats were made out approaching on all sides. A heavy cannonade and fire of musketry and machine guns was opened, and it was adjudged that the torpedo boats were all put out of action before they approached near enough to the fleet to discharge their torpedoes. Although the success remained with the fleet, the torpedo boats were admirably manœuvred. They had made out the enemy at eight o'clock, and had followed it at a distance of three miles without their proximity being suspected. Their attack was executed concentrically in three groups, and the movement was so well judged that all the torpedo boats arrived at the same time in proximity to the enemy. It must be observed that the fleet was acting under peculiarly favourable conditions, as it was aware of the night upon which it would be attacked; while in the case of real war this could not be the case, and a fleet blockading a coast would have to remain night after night in a state of expectancy, and would only be attacked at a moment when

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long watching in vain had produced lassitude and carelessness. Under such circumstances the attack would have a chance of success." These last criticisms are almost identical with those which we made upon the battle of the booms in Bantry Bay.

REPORT BY LIEUTENANT LEROY TO VICE-ADMIRAL THE PRÉFET MARITIME AT TOULON, DESCRIBING THE VOYAGE OF TORPEDO BOATS FROM BREST TO TOULON.

ADMIRAL.—I have the honour to send you a Report of my passage from Brest to Toulon.

29th of January. *29th January.*—My trials being completed, I made some observations while in the roadstead, to determine the deviations of my compasses.

30th of January. The following day, the 30th of January, the wind had veered to the south-west, but the barometer was still high, and I decided to make an attempt to start. At 8.45 in the morning I weighed. On entering the Goulet, I found a considerable sea, and, the wind being fresh from the south-west, I was immediately obliged to reduce speed, the screw being completely emersed with the pitching of the vessel, and the engines racing considerably. Shortly afterwards, heavy squalls completely concealed the land. The wind increased at the same time, and the barometer was falling rapidly. The behaviour of the torpedo boat was satisfactory. If necessary we could have remained cruising at the entrance to Brest. To continue at sea, however, in these conditions was a waste of coal. We were making little way, and some accident might have occurred causing considerable delay. I decided, therefore, to bear up for Brest.

On the 31st and the 1st of February a heavy gale was experienced from the south-west. The barometer was constantly falling, and the signal stations at Ushant and Cape St. Matthieu reporting a high sea with strong wind from the south-west, I was obliged to wait.

Departure from Brest. On the 2nd February, a slight rise was visible in the barometer; the wind was somewhat more northerly, and there were indications of better weather. At 8.45 in the morning I weighed. Two hours were spent in again testing the deviations of the compass. At 10.45 I passed through the Goulet. Outside I found a steady westerly wind, but with a heavy swell from the south-west. The torpedo boat steamed at a moderate speed—215 to 220 revolutions per minute. About this time it was reported that the water was entering in large quantities into the fore-hold, the leakage being caused by the imperfect caulking of the hatches.

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February 2nd.—I did not hesitate in the circumstances to return to Camaret, where I made fast to a buoy. The hatches were well caulked by temporary expedients, and, after a delay of two hours, I was enabled to proceed. In the mean time the barometer began to fall, with an increasing swell from the south-west. I persevered, however, in the endeavour to double the Raz-de-Sein, hoping, as it so often happens, to find less sea and better weather on the other side. On approaching the Raz the mist became so thick that in the squalls I lost sight completely of the land. I could not even see the Toulinguet, although it was close at hand. In these circumstances, deeming it imprudent to attempt to double the Raz, I bore up for Douarnenez, steering along the southern shores of the bay, which I knew were quite clear. I succeeded in making the land, and at 3.50 I made fast to the buoy to the east of the jetty, without communicating with the land. Camaret.

The wind freshened considerably in the night of the 2nd and 3rd of February, blowing from the west and west-north-west. No change in the weather took place from the 3rd to the 4th. A high sea was running, but I was well moored. On the 4th, in the morning, the barometer again rose, indicating a decided shift in the wind to the north-west. At six, I weighed, and attempted to double the Raz. Unfortunately I soon encountered a mountainous sea; the engines raced heavily, and I was compelled to bear up for Le Cap Chère. Douarnenez.

February 4th.—At 8.45, I anchored at Morgat Bay, and not having communicated with the shore at Douarnenez, I was obliged to take in water and fresh provisions. I watched the weather carefully, and in the evening I saw that the wind was going round to the north, and that the swell was not so heavy. Morgat Bay.

At three in the morning of the 5th of February I again started. I still found a considerable swell, but running more from the north and on my beam as I was steering for the Raz. The wind was moderating, and going round to the north. The torpedo vessel rolled, but did not labour heavily.

At 4.45 I had doubled the Raz, and after passing Penmarc the weather improved very much. I steered straight for Oleron, and communicated by semaphore with Belle Isle.

Not being acquainted with the torpedo boat under my command, and the crew, I thought it prudent, in this first attempt at an extended cruise, to feel the pulse a little, and not to steer straight across the Gulf, although during the day the barometer rose and the indications of weather were favourable. The swell, however, was still very heavy from the south-west, and towards three o'clock in the

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evening squalls set in from the west and south-west, with a fall in the barometer, and an ugly appearance on the horizon. Towards six in the evening the weather was hazy, but I made out clearly the light-house on the Baleines, and with some difficulty I afterwards made Chauveau and Chassleur. At seven in the evening I was due west of Chauveau, and at 8.40 in the evening, seventeen hours after having left Douarnenez, I was anchored near the Island of Aix.

Island of Aix.

5th of February, in the evening, to the morning of the 7th.

The engine had worked easily during the voyage. The swell was long and the torpedo boat behaved well. The screw being always immersed, a speed of 13 knots could be maintained with 220 revolutions. The compasses gave no trouble. The log was hauled three times during the passage; the speed, as determined by the revolutions, being found to be quite correct.

Port des Barquez

7th to 8th February.—Tubes were cleaned, the boilers, the turret, and every part of the vessel undergoing the same operation. In the meantime a supply of coal, water, and provisions was taken on board. On the evening of the 7th I sent the crew ashore for a short rest after five days spent in the torpedo boat; and the next day, at ten o'clock in the morning, we were ready to resume the voyage. At 4.15 in the afternoon, as the tide began to rise, we left the Charente and steered for Ferrol. The torpedo boats Nos. 70 and 71 were in the roadstead of the island of Aix, having just arrived from Brest.

On the passage from Brest to Rochfort I had satisfied myself that I could put confidence in the engine and the crew. The weather was fine, and as there was some east in the wind, I determined to steer direct for Ferrol. As we went on, the breeze freshened from north-east; a long deep swell was rolling in from the north-west; but the torpedo boat behaved admirably.

Passage across Bay of Biscay.

At eight in the morning of the 9th I had no difficulty in taking an observation. At noon I fixed the position, and found that we had been driven, since the preceding evening, sixteen miles to the south-east.

I altered the course, and again fixed the position at three o'clock in the afternoon. My chronometers had been on board eleven days, but were going satisfactorily.

Having altered the course, I was steering for Ferrol before a heavy sea and a strong wind from the north-east, but, with a following wind and sea the torpedo boat behaved extremely well. All the hatches were opened; there was no difficulty in cooking. The rolling was slight, and indeed I found it less trying than on board a large ship.

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That which is wearying on board a torpedo boat, and is indeed extremely trying to a sensitive nervous system, is the continual vibration and the racing of the engines with a violence which almost suggests that the engine must come to pieces. The strain is moral rather than physical, but it tells on the whole system. After a time, however, one grows used to it. The racing of the engine whenever the screw is out of water tells seriously on the speed, and when cruising alone I should think it hazardous to attempt to steam at full speed under those conditions. It would, however, be desirable to make experiments to see whether the machinery is capable of enduring such a heavy strain. It is obvious that, if it is necessary to operate in a torpedo boat against a large ship, it would be necessary to steam at full speed. Further experiments are required to determine the value of a torpedo boat in all weathers.

Ferrol.

9th to 11th February.—After six o'clock in the evening all the lights were in sight, and at half-past ten I was anchored at Ferrol. There had been much leakage in the forward compartment. After a most careful examination, it was discovered that a rivet had been started. The rivet holes were closed with wooden plugs. No delay took place in obtaining supplies at Ferrol.

The torpedo boat No. 66 sailed a few hours after my arrival at Ferrol; Nos. 71 and 72 arrived a few hours before my departure. On leaving the harbour, off Corunna, I met the torpedo boat No. 70 steering in for the land, having probably been driven too far to the westward.

On the 11th of February, at 11.35 in the morning, I left Ferrol, the wind blowing fresh from the north-east with a heavy swell. The weather was fine, and, steaming at 220 revolutions, a speed of 14 knots was easily maintained. After passing Cape Finisterre, during the night, I was obliged to slacken speed, the swell having increased very much and the screw being frequently immersed; I was nevertheless able easily to steam at 190 revolutions, and to maintain a speed of 12 knots.

Off Finisterre.

At four o'clock in the evening I passed a little less than three miles to the westward of Cape Finisterre. Taking my departure from this point, I steered straight for the Berlings: the swell was very heavy and steep. The quartermaster watched the course from the steering-compass, and the greatest care was required to prevent the torpedo boat from yawing, as the swell came up on the quarter and brought the vessel into the wind.

At night we made the light of Vigo.

On the 12th, at daybreak, no land was in sight. At 6.30 a bank

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of clouds was seen in the north-east, which I supposed must be hanging over the Cape Mondego. In order to lose no time, and to make sure of my exact position, I steered straight for the land; but, as I proceeded, the mist became more thick, and at 7.15 I was in a dense fog. I then thought it more prudent to steer to the south or a little to the west of south until eight o'clock. It then cleared, and I was able once more to steer straight for the land, which I very shortly afterwards made out. I found myself, as I had expected a few miles to the west of the Alto de Facho, and six miles more to the north than I had expected. Notwithstanding the heavy swell we had therefore been able to make our course tolerably accurately, and there had been no deviation of the compasses. Steering for Lisbon at 10.15, I sighted the Berlings in the south-west. At 2.15 I was to the west of the rock, and increased the speed to 13 knots.

Lisbon.

12th to 17th February.—On approaching Belem, I passed torpedo boat No. 66, which was leaving Lisbon and proceeding to sea. At three o'clock in the afternoon, on the 12th of February, I was anchored near to Belem. On the 13th torpedo boats Nos. 71 and 72 arrived. On the 14th, after sunset, the wind blew strong from the south-west, and, as a measure of precaution, steam was raised, and we shifted our anchorage. On the 15th we received a visit from an English officer who had been sent by the English admiral.

Departure from Lisbon.

On the 17th, towards noon, the barometer was rising, and the wind falling. At half-past six in the evening, all the torpedo boats got under way together. We found a heavy sea on the bar, causing much racing of the engines; but outside the bar the sea was more moderate, and we proceeded at 11 knots. At 7.15 we were west of Cape Espichel, distant five miles. On the 18th, at three minutes past two in the morning, I was abreast St. Vincent. We had had a heavy beam sea after leaving Espichel, but, although rolling heavily, the vessel did not labour nor ship much water. As the day advanced, the swell diminished. The squalls from the south-west were less heavy. The torpedo boats Nos. 71 and 72 were astern of me. At 2.30 in the afternoon, we made the entrance to the Straits of Gibraltar, Spartel, Trafalgar, and the Apes Hill. At four o'clock the Dayot passed close to us, between Tarifa and Tangiers. We showed our number. The seamen went into the rigging to cheer us. Torpedo boats Nos. 71 and 72 were still astern of me. No. 70 had just appeared in sight. I communicated by semaphore at Tarifa, and, increasing the speed in the Straits, where the sea was quite smooth, with no wind, I proceeded to Malaga, where I anchored at ten o'clock in the evening.

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I left behind me the other torpedo boats, which disappeared in the darkness of night, and which I did not see again.

18th to 20th February.—On the 19th I took provisions on board, coal and water, and sent the crew on shore. Between Lisbon and Malaga there had been much less leakage. On the 20th, at a quarter to one, I weighed from Malaga. At 4.20 I was off Sacratifi; at seven off Sabinal. The wind was east, with a little swell; speed, 13½ knots. At 8.40, in the evening, we were off Cape de Gat. On the 21st, at four in the morning, we had doubled Cape Palos, where we found a heavy swell from the north-east, which continued until we had passed Alicante. Malaga.

February 21st to 23rd.—At eleven in the morning I passed close to Cape St. Antonio, and at 2.40 in the afternoon anchored in the Grao of Valencia. On the 22nd I took on board supplies of water, provisions and coals. On the 23rd, at 7.10 P.M. in the morning, we proceeded to Toulon with a light wind from the north-west and a south-east swell; speed, 13 knots. Shortly after midnight, on the 24th, we doubled St. Sebastian, and, at 1.30 in the afternoon, we anchored at Toulon. Valencia.

I draw the following conclusions from experiences of the voyage:— Conclusions.

Habitability.—It is quite possible to live in reasonable comfort on board a torpedo boat. The changes of temperature are considerable, and in the interior of the vessel there is much humidity; but it is possible to bear all this for a few days at sea. For example, during our anchorage at Duarnenez, where the weather was very bad, and where we rolled and pitched for several days, exposed to a strong wind and sea and continual rain, we did not suffer to such a degree as to make life on board absolutely wretched. It was, at any rate, tolerable for sailors. Cooking was always possible, and as I gave my crew considerable indulgence, they assured me that they found their fare on board the torpedo boat superior to the monotonous rations of the large ships.

Compasses.—These gave me no trouble.

Anchors.—Our anchors were somewhat small, and it would be desirable to have a greater scope of chain cable.

Machinery.—In this department all was satisfactory.

Health of the Crew.—I had no man on the sick list. I am bound, however, to say that the men under my orders were sturdy fellows. I felt it my duty to express to them my thorough satisfaction with the spirit and good humour which they had displayed in all circumstances. The engineers were accustomed to torpedo boats. They

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were men who had had considerable training at Brest, and they did their duty thoroughly throughout the passage. It is absolutely necessary that the crew of a torpedo boat should be thoroughly accustomed to this class of vessel.

In concluding my report, I have to express my regret that the bad weather against which I contended at the outset delayed me somewhat. I also regret the unfortunate visit to Lisbon. Notwithstanding these small annoyances, I have been able to establish that it is possible to navigate the seas in a torpedo boat. With something of the resignation which belongs to seamen, life is not insupportable. The fatigue is not extreme; the suffering from damp is not absolutely intolerable; the officers in command can be tolerably well fed, by accepting the rations of the crew. The cooking was always good. This duty was carried out by one of the seamen. It may be admitted that it is cold at night and very hot by day, when the sun is fully out at noon; but these are annoyances which may easily be borne.

The rolling is not extreme, even with a heavy swell. Not much sea comes on board. With a following sea, even in heavy weather, comparatively little movement is felt. With the sea and wind ahead, or even before the beam, the torpedo boat is swept from end to end. The wind is cutting, and the torpedo boat labours heavily; under such conditions, it is much to be regretted that the engine cannot be made to work at a slower speed. This extreme speed in a heavy sea is one of the great defects of the torpedo boats, and must, if the vessel were exposed for a long period to heavy weather, result in considerable damage.

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CHAPTER XVIII.

Conclusion.

In concluding, two points may be specially urged: let there be less of self-depreciation and less of party spirit in dealing with the Navy. In recent years the naval debates in Parliament have been free from the acrimony formerly displayed. The discussions in the House of Commons on naval matters were lifted out of the region of party conflict. It was agreed on both sides to treat the affairs of the Navy as a common object, in which, if the rivalry of party was to be felt at all, it should be displayed not in mutual recrimination, but in striving which would contribute most from his stores of knowledge and experience for the advantage of the public service. In asking for a full and fair recognition of the strength and resources of the Navy, as it was handed over by Lord Northbrook's Board to their successors, the present writer disclaims any special share of credit. The strength of the Navy as we see it to-day, in its officers and men, in its ships, in the great stations and establishments which it possesses in all parts of the world, is the result of the labour of a long succession of Boards of Admiralty, and it is intimately bound up with the history of the country. The ablest Ministers in a short and precarious term of office can add but little to our maritime power. A short interval of bad administration may do much to weaken it. The compiler of this volume does not shrink from the admission that it was the aim of the Admiralty under which he had the honour to serve to discourage, by the example of moderation, the extravagant expenditure of Continental Powers, and, in common with his colleagues, he deeply regretted that the good example was not followed. In the circumstances they were compelled to ask the consent of Parliament to a large increase or expenditure. Having become convinced that a forward movement must be made, they resolved that their proposals to Parliament should not be half measures, but should be adequate to uphold their country as the mistress of the seas.

It may be that undue hesitation was shown in proposing the additions recently made to the Navy estimates. Our regret may

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in some degree be mitigated by the conviction that our resources for construction and manufacture give us a greater power than we could possibly derive from an unlimited reserve of ships and weapons which the process of invention tends to render obsolete. In 1814, with a population of 18,000,000, we had 147,000 seamen and marines. In three and a half years the Americans increased their Navy from 42 ships to 700, and their seamen from 7,000 to 51,000.

In the Crimean war, when our industrial resources were far less than at present, three floating batteries of 3000 tons, and protected by 4-inch armour, were completed in the short space of three months. In five months more than 200 gunboats and 100 mortar-boats were completed for sea. In three months from the date of signing the contract the establishment of Mr. John Penn produced and fitted on board the gunboats 80 engines of 64 horse-power. It was thus that we were enabled, as Lord Palmerston reminded the House of Commons, to raise the strength of the Navy from 212 ships in commission in February 1854, to 590 ships in commission in March 1856.

The increase in the Navy Estimates proposed by Lord Northbrook for 1884–85 having been maintained by the two Administrations who have succeeded, both parties are committed to a more active and energetic policy. The expenditure now sanctioned should enable us to keep well to the front as a Naval Power.

Our memories of our vast achievements, our confidence in our maritime strength, and in our determination to use it on a just occasion, would surely justify, not less in the present than in any former age, the proud boast of Lord Nelson: "If England is true to herself, she may bid defiance to Europe. We have been called in ridicule a nation of shopkeepers. So, I hope, we shall always remain, and like other shopkeepers, if our goods are better than those of any other country, and we can afford to sell them cheaper, we may depend on our shop being well resorted to." In the anxious desire to arouse public opinion, and to bring pressure to bear upon the Government, accuracy has been too little regarded in the comparisons of our Navy with foreign fleets from time to time presented to the public. Happily these pessimist views are not accepted abroad with the credulity so readily displayed at home. Foreign observers know full well that we are not defenceless, and they have a wholesome respect for our naval power. This impression is our best protection against the miseries of war.

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SECTION II.

BRITISH AND FOREIGN ARMOURED AND UNARMOURED SHIPS.

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BRITISH ARMOURED AND UNARMOURED SHIPS.

THE list of ships of the British Navy has been compiled from various sources. The official *Navy List* for January, 1886, has been the principal guide. As a rule the displacement and indicated horse-power have been given as therein stated. Wherever possible the column under the heading "speed" has been filled up from reports of actual trial. With respect to the gun and torpedo armament, it is to be noted that, owing to the substitution of breech-loaders for muzzle-loaders at present in progress, to the advance in the power of machine-guns, and to the improved methods of ejecting locomotive torpedoes, changes are being continuously made. The columns for "coal-endurance" have been filled, as far as was possible, from the most authentic reports on the trials of the several ships. Generally the mileage traversible at the speed mentioned has been computed from the quantity of fuel that can be carried in the bunkers. The computations, moreover, have been based upon performances, or estimates of performances, under the most favourable conditions.

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GREAT BRITAIN.—Armoured Ships.

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret-ship; *w.*, wooden hull; 2 *s.*, two screws.

M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; l., light guns under 15 cwt., including boats' guns; M., machine gun; Q.F., quick-firing gun; *comp.*, compound or steel-faced armour; tu., torpedo-tube or launching carriage.

Class.	NAME.	Displacement.	Indicated Horse-Power.	Draught of Water. Extreme.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Completion.	Cost.		Armour.			Backing.	Armament.		Speed.	Coal Endurance.	
										Hull.	Machinery.	Side.	Bulkhead.	Turret.		Guns.	Tubes for Torpedoes.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
		tons.		ft. in.	ft. in.	ft. in.				£	£	in.	in.	in.	in.			knots.	tons.	knots.
br.	**Achilles** . .	9820	5720	27 3	380 0	58 3½	Chatham	Penn .	1864	375,429	69,117	4½	..	..	18	14 12-ton M.L.R., 2 6½-ton do., 14 l. 14 M.	..	14·32	750	2500
t.	**Agamemnon** 2 *s.*	8510	6360	24 0	280 0	66 0	Chatham	Penn .	1883	402,295	101,770	18	16	16	15 to 16	4 38-ton M.L.R., 2 6-in. B.L.R., 6 l., 14 M.	4-tu.	13·25	960	4100
br.	**Agincourt** . .	10,690	6870	27 9	400 0	59 5	Birkenh'd	Maudslay .	1868	381,700	83,777	5½	4½	..	10	17 12-ton M.L.R., 14 l., 15 M.	2-tu.	14·8	750	1300
t.	**Ajax** . . 2 *s.*	8510	6440	24 0	280 0	66 0	Pembroke	Penn .	1883	411,622	106,735	18	16	16	15 to 16	4 38-ton M.L.R., 2 6-in. B.L.R., 2 l., 14 M.	2-tu.	13·25	960	4100
c.b.	**Alexandra** . 2 *s.*	9490	8610	26 6	325 0	63 8	Chatham	Humphrys	1877	394,263	120,061	12 to 16	8	..	12 & 10	2 25-ton M.L.R., 10 18-ton do., 11 l., 4 Q.F., 15 M.	4-tu.	15·00	680	2700
b.	**Anson** . . 2 *s.*	10,000	9500	26 9	330 0	68 6	Pembroke	Humphrys	Bldg.	*x* 578,696	*y* 108,720	18	16	14 *comp.*	25 to 15	4 67-ton B.L.R., 6 6-in. do., 15 Q.F., 10 M.	4-tu.	17·0	1200	7100
c.b.	**Audacious** . 2 *s.* (Zinc Sheathed)	6010	4830	23 2	280 0	54 0	Glasgow	Ravenhill .	1869	193,863	52,619	8 to 6	5	..	10	10 12-ton M.L.R., 8 4-in. B.L.R., 5 l., 4 Q.F., 11 M.	4-tu.	12·83	500	1260
a.c.	**Aurora** (1) . 2 *s.*	5000	8500	22 6	300 0	56 0	Pembroke	. .	Bldg.	*x* 215,550	*y* 64,000	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2-in. B.L.R., 10 6-in. B.L.R., 14 Q.F. & 4 M.	-tu.	18·0	900	8000
a.c.	**Australia** (1) 2 *s.*	5000	8500	22 6	300 0	56 0	Glasgow	Napier .	Bldg.	195,390	63,000	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2-in. B.L.R., 10 6-in. B.L.R., 14 Q.F. & 4 M.	-tu.	18·0	900	8000

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c.b.	**Belleisle** .	2 *s.*	4870	3200	19	9	245	0	52	0	Poplar .	Maudslay .	1878	240,000 (purchased)		12,10,8,4	9,6,5	..	16 & 19	4	25-ton M.L.R., 6 l., 8 M.	2-tu.	12·20	510	1824
a.b.	**Bellerophon** (p.166)		7550	6520	26	7	300	0	56	1	Chatham	Penn .	1866	235,738	86,963	6	5	8 pilot tower.	10	10	8-in. B.L.R., 4 6-in. do., 6 4-in. do., 4 l., 4 Q.F., 12 M.	-tu.	14·17	650	1610
b.	**Benbow** (1) .	2 *s.*	10,000	9500	27	3	330	0	68	6	Blackwall	Maudslay .	Bldg.	*x* 650,820	*y* 110,000	18 *comp.*	16 *comp.*	14 & 12 *comp.*	25 to 15	2	110-ton B.L.R., 10 6-in. do., 11 Q.F., 10 M.	4-tu.	17·00	1200	7100
br.	**Black Prince** .		9210	5770	26	10	380	2	58	4	Glasgow .	Penn .	1862	283,154	74,482	4½	4½	..	18	4	9-ton M.L.R., 22 6½-ton do., 2 6-in. B.L.R., 10 l., 8 M.	..	13·60	750	1080
b.	**Camperdown** (2)	2 *s.*	10,000	9500	27	3	330	0	68	6	Portsm'th	Maudslay .	Bldg.	*x* 578,766	*y* 109,350	18 *comp.*	16 *comp.*	12 to 14 on barbette *comp.*	10 to 15	4	67-ton B.L.R., 6 6-in. do., 15 Q.F., 10 M.	5-tu.	17·00	1200	7100
b.	**Collingwood** (4) (5)	2 *s.*	9150	9570	26	3	325	0	68	0	Pembroke	Humphrys	1886	491,000	95,870	18	16	12 to 14 on barbette	9 to 20	4	43-ton B.L.R., 6 6-in. do., 12 Q.F., 13 M.	4-tu.	16·40	1200	8500
t.	**Colossus** (6) (7)	2 *s.*	9150	7490	26	3	325	0	68	0	Portsm'th	Maudslay .	1886	533,000	80,160	18	16½	14	9 to 14	4	43-ton B.L.R., 5 6-in. do., 4 l., 4 Q.F., 15 M.	2-tu.	15·50	970	6200
t.	**Conqueror** (8)	2 *s.*	6200	6000	24	0	270	0	58	0	Chatham	Humphrys	1882	325,000	93,433	12 to 8½	11½ to 10½	12	10 to 13½ on sides, 9 on bulkheads.	2	43-ton B.L.R., 4 6-in. do, 4 l., 6 Q.F., 11 M.	2-tu.	15·50	650	5200
c.s., *t.*	**Cyclops** .	2 *s.*	3480	1660	16	4	225	0	45	0	Blackwall	Elder .	1871	136,426	17,600	8 & 6	9 & 8 in breastwork.	9 & 10	9 & 11	4	18-ton M.L.R., 1 l., 4 Q.F., 2 M.	..	11·03	250	1920
br.	**Defence** . .		6270	2540	26	1	280	0	54	2	Jarrow .	Penn .	1862	197,879	34,357	4½	4½	..	18	2	9-ton M.L.R., 14 6½-ton do., 4 l., 6 M.	..	11·62	450	1100
t.	**Devastation** (9)	2 *s.*	9330	6650	27	6	285	0	62	3	Portsm'th	Penn .	1873	290,660	63,188	12 & 10	..	14 & 12	18 to 16	4	35-ton M.L.R., 6 Q.F., 2 l., 12 M.	2-tu.	13·84	1800	5980
t.	**Dreadnought**	2 *s.*	10,820	8210	26	9	320	0	63	10	Pembroke	Humphrys	1875	485,573	107,000	14,13, 11,10	..	14	18 to 15	4	38-ton M.L.R., 6 Q.F. & 14 M.	2-tu.	14·20	1330	5720
t.	**Edinburgh** (9)	2 *s.*	9150	7520	26	3	325	0	68	0	Pembroke	Humphrys	1886	522,333	77,000	18	16½	14	to 14	4	43-ton B.L.R., 5 6-in. do., 4 Q.F., 15 M.	2-tu.	15·50	970	6200

x Includes Hydraulic Machinery, Gun Mounting, &c. *y* Propelling Machinery

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GREAT BRITAIN.—Armoured Ships—*continued.*

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t*, turret-ship; *w.*, wooden hull; 2 *s.*, two screws.

M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; l., light guns under 15 cwt., including boats' guns; M., machine gun; Q.F., quick-firing gun; *comp.*, compound or steel-faced armour; tu., torpedo-tube or launching carriage.

Class.	NAME.	Displacement.	Indicated Horse-Power.	Draught of Water. Extreme.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Completion.	Cost.		Armour.			Backing.	Armament.		Speed.	Coal Endurance.	
										Hull.	Machinery.	Side.	Bulk-head.	Turret.		Guns.	Tubes for Tor-pedoes.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
		tons.		ft. in.	ft. in.	ft. in.				£ *x*	£ *y*	in.	in.	in.	in.			knots.	tons.	knots.
a.c.	**Galatea** (1) . .	5000	8500	22 6	300 0	56 0	Glasgow .	Napier	Bldg.	195,390	63,000	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2-in. B.L.R., 10 6-in. do., 14 Q. F. & 4 M.	-tu.	18·	900	8000
c.s., *t.*	**Glatton** . 2 *s.*	4910	2870	19 0	245 0	54 0	Chatham	Laird .	1872	189,133	30,396	12to10	14 to 12	18to20	10	2 25-ton M.L.R., 2 l., 3 Q.F., 4 M.	2-tu.	12·11	540	2000
c.s., *t.*	**Gorgon** . 2 *s.*	3480	1670	16 4	225 0	45 0	Jarrow	Ravenhill	1872	122,904	15,663	8 & 6 on breast-work.	9 & 8	9 & 10	11 to 9	4 18-ton M.L.R., 2 l., 6 M.	..	11·14	270	1230
c.s., *t.*	**Hecate** (11) . 2 *s.*	3480	1750	16 4	225 0	45 0	Poplar	Ravenhill	1872	124,906	15,687	8 & 6 on breastwork.	9 & 8	9 & 10	11 to 9	4 18-ton M.L.R., 1 l., 6 M.	..	10·90	270	1230
br.	**Hector** . . .	6710	3260	26 0	280 2	56 5	Glasgow	Napier	1864	237,438	45,764	4½	4½	..	18	2 9-ton M.L.R., 16 6½-in. do 6 l., 8 M.	..	12·36	460	1460
c.b.	**Hercules** . .	8680	6750	26 6	325 0	59 0½	Chatham	Penn	1868	278,320	82,814	9 to 5	6	..	12&10	8 18-ton B.L.R., 2 13-ton do., 4 7-in. do., 6 l., 2 Q.F., 14 M.	4-tu.	14·00	610	1760
t.	**Hero** . . 2 *s.*	6200	6000	24 0	270 0	58 0	Chatham	Rennie	1887	*x* 342,971	*y* 58,300	12 *comp.*	11½ *comp.*	12 *comp.*	13½	2 43-ton B. L. R., 4 6-in. do., 4 l., 7 Q.F., 11 M.	-tu.	15·5	650	5200
c.s., *t.*	**Hotspur** . 2 *s.*	4010	3060	20 8	235 0	50 0	Glasgow .	Napier	1871	135,067	36,461	11 & 8	8	10	15to12 on side 10 on turret.	2 25-ton M.L.R., 2 6-in. B.L.R., 2 l., 4 Q.F., 8 M.	2-tu.	12·65	300	920

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b.	**Howe** . .	2 *s.*	9700	9500	26	3	325	0	68	0	Pembroke	Humphreys	1887	560,469 *x*	106,553 *y*	18	16	11½ to 10 on barbette.	9 to 20	4	67-ton B.L.R., 6 6-in. do., 15 Q.F., 10 M.	4-tu	17·0 forced.	1200	7200
c.s., *t.*	**Hydra** . .	2 *s.*	3480	1470	16	4	225	0	15	0	Glasgow	Elder	1872	124,454 *x*	16,918 *y*	8 & 6	9 & 8	9 & 10	11 to 9	4	18-ton M.L.R., 2 l., 6 M.	..	11·20	250	1920
a.c.	**Immortalité** (1)	2 *s.*	5000	8500	22	6	300	0	560		Chatham	..	Bldg.	215,500 *x*	57,000 Estd. *y*	10 *comp.*	16 *comp.*	12 conning tower.	6	2	9·2-in. B.L.R., 10 6-in. do., 14 Q.F. 4 M.	tu.	18·00	900	8000
a.c.	**Imperieuse** . (Copper sheathed.)	2 *s.*	7390	10,180	25	5	315	0	62	0	Portsm'th	Maudslay	1886	405,000	104,500	10	9	8 on barbette.	10	4	18-ton B.L.R., 6 6-in. do., 4 l., 4 Q.F., 14 M.	6 tu.	17·00 forced.	1200	7300
t.	**Inflexible** .	2 *s.*	11,880	8010	25	5	320	0	75	0	Portsm'th	Elder	1881	648,811	146,457	24, 20, 16	22, 18, 14	16 *comp.*	17 to 25	4	80-ton M.L.R., 8 l., 4 Q.F., 17 M.	3 tu.	13·80	1300	5200
c.b.	**Invincible** .	2 *s.*	6010	4830	22	9	280	0	54	0	Glasgow	Napier	1870	187,055	52,386	8 to 6	5	..	10		10 12-ton M.L.R., 6 4-in. B.L., 4 l., 4 Q.F., 15 M.	4-tu.	14·09	500	1580
c.b.	**Iron Duke** .	2 *s.*	6010	3520 forced.	22	7	280	0	54	0	Pembroke	Ravenhill	1871	146,314	50,165	8 to 6	5	..	10		10 12-ton M.L.R., 4 5-in. B.L.R., 8 l., 4 Q.F., 14 M.	4-tu.	13·64	700	3900
w., *br.*	**Lord Warden** .		7840	6700	27	11	280	0	59	0½	Chatham	Maudslay	1867	247,009	68,582	4½ & 5½	..	..	31½	2	12-ton M.L.R., 14 9-ton do., 2 6½-ton do., 10 l., 8 M.	..	13·50	630	1360
br.	**Minotaur** . .		10,690	6700	27	5	400	0	59	4½	Blackwall	Penn	1867	377,325	79,505	5½	4½	..	10		17 12-ton M.L.R., 2 6-in. B.L.R., 14 l., 15 M.	4 tu.	14·41	750	1200
t.	**Monarch** . .		8320	7840	26	0	330	0	57	6	Chatham	Humphrys	1869	279,903	74,672	7 to 4	5	10 & 8	12	4	25-ton M.L.R., 2 12-ton M.L.R., 1 6½-ton M.L.R., 3 l., 14 M.	4 tu.	14·94	630	1500
a.c.	**Narcissus** (1)	2 *s.*	5000	8500	22	6	300	0	56	6	Hull	Earle Co.	Bldg.	195,890 *x*	61,500 *y*	10 *comp.*	16 *comp.*	12 conning tower.	6	2	9·2-in. B.L.R., 10 6-in. B.L.R., 14 Q.F., 4 M.	8 tu.	18·00	900	8000
a.c.	**Nelson** . (Zinc sheathed.)	2 *s.*	7630	6640	24	8	280	0	60	0	Glasgow	Elder	1880	303,310	87,545	9 & 6	9, 8, 6	..	13, 10, 11	4	18-ton M.L.R., 8 12-ton M.L.R., 10 l., 2 Q.F., 15 M.	4 tu.	14·41	1150	5200
t.	**Neptune** . . (Copper sheathed.)		9310	8000	25	0	300	0	63	0	Poplar	Penn	..	600,000 (purchased)		12 to 8	8	11 & 13	11 to 13	4	38-ton M.L.R., 2 12-ton M.L.R., 4 l., 6 Q.F., 15 M.	2 tu.	14·20	670	1480

x Includes Hydraulic Machinery, Gun Mountings, &c. *y* Propelling Machinery.

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GREAT BRITAIN.—Armoured Ships—*continued.*

a.c., armoured cruiser; *a.g.b.*, armoured gun boat; *b.*, barbette-ship; *br.*, broadside ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t*, turret-ship; *w.* wooden hull; 2 *s.*, two screws.

M.L.R., muzzle-loading rifled gun; B.L.R. breech-loading rifled gun; l., light guns under 15 cwt., including boats' guns; M., machine gun; Q.F., quick-firing gun; *comp.*, compound or steel-faced armour; tu., torpedo-tube or launching carriage.

Class	NAME.	Displacement.	Indicated Horse-Power.	Draught of Water. Extreme.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Completion.	Cost.		Armour.			Wood Backing.	Armament.		Speed.	Coal Endurance.	
										Hull.	Machinery.	Side.	Bulk-head.	Turret.		Guns.	Tubes for Torpedoes.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
		tons.		ft. in.	ft. in.	ft. in.				£ *x*	£ *y*	in.	in.	in.	in.			knots.	tons.	knots.
t.	**Nile** (12). . 2 *s.*	14,940	12,000	27 6	345 0	73 0	Pembroke	..	Bldg.	765,794	98,000	20 to 16	18 to 14	18	6	4 67-ton B.L.R., 8 5-in. do., 18 Q.F.	tu.	16·50	1200	6500
a.c.	**Northampton** (Zinc sheathed.) 2 *s.*	7630	6070	24 8	280 0	60 0	Glasgow	Penn	1878	296,836	98,968	9 & 6	9,8,6	..	13,10, 11	4 18-ton M.L.R., 8 12-ton M.L.R., 10 l., 15 M.	4 tu.	13·20	1150	3850
br.	**Northumberland**	10,780	6560	27 9	400 4	59 5	Millwall	Penn	1868	391,481	79,871	5½	4½	5½ conning tower.	10	7 12-ton M.L.R., 20 9-ton do., 14 l., 14 M.	4 tu.	14·13	756	1270
c.b.	**Orion** . . 2 *s.*	4870	4040	19 9	245 0	52 0	Poplar	Maudslay	1882	239,270	52,959	12, 10, 8, 6, 4	6,5	..	16 & 9	4 25-ton M.L.R., 2 l., 6 Q.F., 8 M.	4 tu.	13	520	1830
a.c.	**Orlando** (1) . 2 *s.*	5000	8500	22 6	300 0	56 0	Jarrow	Palmer	Bldg.	*x* 206,647	*y* 60,165	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2 in. 22-ton B.L.B., 10 6-in do., 14 Q.F., 4 M.	tu.	18·00	900	8000
c.b.	**Penelope** . 2 *s.*	4470	4700	17 6	260 0	50 0	Pembroke	Maudslay	1868	145,993	40,855	6 & 5	4½	..	10 & 11	8 9-ton M.L.R., 3 40-pdrs., B.L.R., 2 20-pdrs. B.L.R., 4 l., 8 M.	..	12·76	470	1360
c.s., *t.*	**Prince Albert** .	3880	2130	20 4	240 0	48 1	Poplar	Humphrys	1866	178,537	24,129	4½	..	10	18	4 12-ton M.L.R., 2 l., 6 M.	..	11·65	230	930
t.	**Renown** . 2 *s.*	10,470	12,000	27 3	340 0	70 0	Newcastle	Humphrys	Bldg.	612,522	112,333	16 to 18 *comp.*	16	18 *comp.*	6	2 110-ton B.L.R., 1 29-ton do., 12 6-in. do., 21 Q.F., 6 M.	4 tu.	16·75	1200	7000
w.c.b.	**Repulse** . .	6190	3350	26 2	252 0	57 1½	Woolwich	Penn	1870	156,246	27,394	6	4½	..	31	12 9-ton M.L.R., 9 l. 8 M.	..	12·28	500	1700

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b.	Rodney .	2 *s.*	9700	11,160	27	3	325	0	68	0	Chatham	Humphrys	1887	563,878 *x*	105,400 *y*	18	16	11½ to 10 on barbette	9 to 20	4	68-ton B.L.R., 6 6-in. do., 15 Q.F., 10 M.	4 tu.	17·0	1200	8500
c.s., *t.*	Rupert . .	2 *s.*	5440	4630	23	7	250	0	53	0	Chatham	Napier	1874	193,171	39,506	11	12 breast-work.	14 turret.	14 & 10	2	18-ton M.L.R., 2 6-in. B.L.R., 2 l., 4 Q.F., 8 M.	4 tu.	13·59	480	1340
t.	Sans Pareil .	2 *s.*	10,470	12,000	27	3	340	0	70	0	Blackwall	Humphrys	Bldg.	609,109 *x*	110,333 *y*	16 to 18 *comp.*	16	18 *comp.*	6	2	110-ton B.L.R., 1 29-ton do.; 12 6-in. do., 21 Q.F., 6 M.	4 tu.	16·75	1200	7000
c.s., *t.*	Scorpion . .		2750	1450	16	11	224	6	42	4½	Birkenh'd	Laird	1865	92,033	18,540	4½	..	5 turret.	9	4	12-ton M.L.R., 1 l., 6 M.	..	10·51	320	1210
a.c.	Shannon . . (Zinc sheathed.)		5390	3370	23	4	260	0	54	0	Pembroke	Laird	1877	233,902	53,367	9, 8, 6	..	..	10 & 11	2	18-ton M.L.R., 7 12-ton M.L.R., 8 l., 10 M.	2 tu.	12·35	580	2260
c.b.	Sultan . . .		9200	7720	27	6	325	0	59	0½	Chatham	Penn	1871	281,373	76,042	9, 8, 6	6	..	12 & 10	8	18-ton M.L.R., 4 12½-ton M.L.R., 7 4-in. B.L.R., 4 l., 4 Q F., 11 M.	5 tu.	14·13	810	2140
c.b.	Superb . . .		9170	6580	26	2	232	3	59	0	Blackwall	Maudslay	1880	443,000 (purchased)		12,10,7	10, 7, 6 5	8 on conning tower.	7 to 12	16	18-ton M.L.R., 6 4-in. B.L., 4 l., 6 Q.F. 15 M.	4 tu.	13·80	970	1810
c.b.	Swiftsure . . (Copper sheathed.)		6910	4910	26	0	280	0	55	9	Jarrow	Maudslay	1872	207,940	49,141	8 to 6	6	..	10	10	12-ton M.L.R., 8 4-in. B.L., 5 l., 4 Q.F., 14 M.	4-tu.	13·75	540	1630
c.b. & *b.*	Temeraire . 2 *s.* (Zinc sheathed.)		8540	7520	27	2	285	0	62	0	Chatham	Humphreys	1877	352,015	102,954	11, 10, 9, 8	8—5	10 fore 8 after	12 & 10	4	25-ton M.L.R., 4 18-ton do., 10 l., 6 Q.F., 15 M.	4-tu.	14·50	620	2680
t.	Thunderer . 2 *s.*		9330	6270	27	0	285	0	62	3	Pembroke	Humphreys	1877	306,084	52,458	12 & 10	12 & 10 breast-work.	14 & 12	18 to 16	2	38-ton M.L.R., 2 35-ton do., 6 Q.F., 2 l., 12 M.	4 tu.	13·40	1600	3040
t.	Trafalgar (12)	2 *s.*	11,940	12,000	27	6	345	0	73	0	Portsm'th	..	Bldg.	765,794 *x*	97,000 *y*	20 to 16	18 to 14	18	6	4	67-ton B.L.R., 8 5 in. do., 18 Q.F.	tu.	16·50	1200	6500
c.b.	Triumph . . (Copper sheathed.)		6640	5110	26	2	280	0	55	0	Jarrow	Maudslay	1873	209,109	49,213	8 to 6	6	..	10	10	12-ton M.L.R., 4 5-in. B.L.R., 6 20-pdrs., 4 l., 4 Q.F., 12 M.	4 tu.	12·00	550	1680

x Includes Hydraulic Machinery, Gun Mountings, &c. *y* Propelling Machinery.

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GREAT BRITAIN.—Armoured Ships—*continued.*

a.c., armoured cruise.' *a.g.b.*, armoured gun boat; *b.*, barbette-ship; *br.*, broadside ship; *c.b.*, central battery ship; *c.s.*, coast-service vessel; *t.*, turret ship; *w.*, wooden hull; 2 *s.*, two screws.

M.L.R., muzzle-loading rifled gun: B.L.R., breech-loading rifled gun; l., light guns under 15 cwt., including boats' guns; M., machine gun; Q.F., quick-firing gun; *comp.*, compound or steel-faced armour; tu., torpedo-tube or launching carriage.

Class.	NAME.	Displacement.	Indicated Horse-power.	Draught of Water. Extreme.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Completion.	Cost.		Armour			Backing.	Armament.		Speed.	Coal Endurance.	
										Hull.	Machinery.	Side.	Bulk-head.	Turret.		Guns.	Tubes for Torpedoes.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
		tons.		ft. in.	ft. in.	ft. in.				£	£	in.	in.	in.	in.			knots.	tons.	knots.
a.c.	Undaunted (1) 2 *s.*	5000	8500	22 6	300 0	56 0	Jarrow	Palmer Co.	Bldg.	195,890 *x*	60,165 *y*	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2-in. 22-ton B.L.R., 10 6-in. do., 14 Q.F., 4 M.	tu.	18·0	900	8000
br.	Valiant . .	6710	3350	26 2	280 2	56 4	Poplar	Maudslay	1865	271,964	48,324	4½	4½	..	18	2 9-ton M.L.R., 16 6½-ton do., 4 l., 8 M.	..	12·65	450	1430
a.g. b.	Viper . . 2 *s.*	1230	700	11 8	160 0	32 0	Poplar	Maudslay	1867	43,517	7,610	4½	4½	..	10	2 6½-ton M.L.R., 2 l.	..	9·59	110	—
a.g. b.	Vixen . . 2 *s.* (Copper sheathed.)	1230	740	11 8	160 0	32 5	Deptford Green	Maudslay	1866	46,333	7,860	4½	4½	..	10	2 6½-ton M.L.R., 2 l.	..	8·89	110	—
br.	Warrior . .	9210	5270	26 9	380 2	58 4	Blackwall	Penn	1861	282,284	74,409	4½	4½	..	18	4 9-ton M.L.R., 28 6½ do., 4 l., 8 M.	..	14·40	790	1210
a.c.	Warspite . 2 *s.* (Copper sheathed.)	7390	10,000	25 5	315 0	62 0	Chatham	Penn	1886	404,923 *x*	113,690 *y*	10	9	8 barbette.	10	4 18-ton B.L.R., 6 6-in. do., 4 l., 4 Q.F., 14 M.	6 tu.	17·00 forced.	1200	7300
a.g. b.	Waterwitch (*hydr.*)	1280	780	11 11	162 0	32 1	Blackwall	Dudgeon	1867	44,253	14,522	4½	4½	..	10	2 6½ ton M.L.R., 2 l.	..	8·88	100	—
c.s., t.	Wivern . .	2750	1450	16 8	224 6	42 4	Birkenh'd	Laird	1865	98,118	18,396	4½ & 3	..	5	9	4 12-ton M.L.R., 1 l., 6 M.	..	10·06	300	1150
The following do not appear in the Official Navy List:—																				
c.s., t.	Abyssinia* . 2 *s.*	2900	950	14 6	225 0	42 0	Poplar	Dudgeon	1870	97,049	19,500	7 & 6	On breast-work. 8 & 7	10 & 8	11 to 9	4 18-ton M.L.R., 2 l., 2 M.	..	9·59	92	—
c.s., t.	Cerberus† . 2 *s.*	3340	1370	15 3	225 0	45 0	Jarrow	Maudslay	1870	99,331	18,225	8 to 6	Do. 9 to 8	10 & 9	11 to 9	4 18-ton M.L.R. 4 M.	..	9·75	120	—
c.s. t	Magdala‡ . 2 *s.*	3340	1440	15 3	225 0	45 0	Blackwall	Ravenhill	1870	115,400	17,000	8 to 6	Do. 9 to 8	10 & 9	11 to 9	4 18-ton M.L.R., 2 l., 2 M.	..	10·67	120	—

x Includes Hydraulic Machinery, Gun Mountings, &c. *y* Propelling Machinery. * At Bombay. † At Melbourne, Va. ‡ At Bombay.

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DETAILS OF CONSTRUCTION AND TRIALS OF RECENT SHIPS.*

(1.) Aurora and Sister-ships.

The Aurora and sister-ships.

The armoured or belted cruisers may be regarded as having been evolved out of the unarmoured swift despatch vessels Iris and Mercury, and the more recent vessels of the Mersey class. These cruisers will measure 300 ft. by 56 ft., the displacement being 5000 tons; but instead of having slopes at the edges of their protective steel decks they will have, as their special feature, a steel-faced armour belt 200 ft. long and 10 in. thick, with 6 in. of backing. They will be fitted with engines of 8500 indicated horse-power, with forced draught. The indicated horse-power of the engines of the Iris and Mercury is 7500, that of the Leander and her sister-ships is only 5500 horse-power, and that of the Mersey class 6000 horse-power. As in the Scouts and Merseys, the boilers will be worked by forced draught in a closed stokehole; while the engines are to be of the horizontal type driving twin-screws. The cylinders will be 42 in. and 71 in. in diameter respectively, with piston-stroke of 42 in. Steam will be provided by four double-ended boilers, working at a pressure of 120 lbs. per square inch, and having a total grate surface of 500 square feet, and their total weight is not to exceed 720 tons. Cast-steel framing and hollow steel shafting will be used throughout, as in the case of the vessels of the Leander class. The hulls of these vessels are to be of steel throughout. They will be minutely subdivided into separate compartments by means of bulkheads, contributing considerably to the structural strength of the vessels. Each vessel will have two 9·2-inch guns, one of them being so placed forward as to be able to fire all round the bow to about 50 deg. abaft the beam, and the other being situated aft to fire through a similar sweep round the stern. There will also be ten 6-in. 4-ton guns, six 6-pounder quick-firing guns, eight 3-pounder quick-firing guns, and four machine guns; and in addition a torpedo armament will be provided both above and under the water-line. Each vessel is to be manned by a crew of from 330 to 350 officers and men, accommodation for whom will be provided on the second deck above the water-line. It is expected that their speed will be 18 knots.

* These notes have been taken generally from articles in English Journals. As they have all undergone editorial modification by way of correction, extension and abridgment, the sources are not acknowledged in detail.

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* The Bellerophon's New Armament.

The Bellerophon.

The Bellerophon now carries in the main battery ten 8-in. 13-ton breech-loading guns, mounted on Vavasseur carriages; on the main deck aft two 6-in. 89-cwt. breech-loading guns, and under the forecastle the same number; on the upper deck six 4-in. 22½-cwt. breech-loading guns; on the upper works, four 6-pounders (Hotchkiss's), eight 1-in. Nordenfelts, two 0·45 Nordenfelts, and two 0·45 Gardners. She also carries twelve 14-in. Whitehead torpedoes, with two electric search lights.

(2.) Benbow.

(Chiefly from the *Engineer*.)

The Benbow.

The ship is 330 ft. long over all, 68 ft. 6 in. beam, and 37 ft. 1½ in. deep. The displacement when ready for sea will be 10,000 tons. The dead weight when launched was 5000 tons. The twin propellers will be worked by two sets of inverted three-cylinder compound engines constructed by Messrs. Maudslay, Sons, and Field; the two high-pressure cylinders are 52 in. diameter, and four low-pressure cylinders 74 in. diameter, with a stroke of 3 ft. 9 in. The contract power of the engines is 7500 horses, with natural draught, and 9500 horses working with forced draught, but will probably exceed 10,000 on the trial trip. The engines are expected to make about 100 revolutions per minute. The surface-condensers and air-pumps are all of brass, and the condensers have collectively a cooling surface of 17,000 square feet. The crank-shafts are of Whitworth compressed steel, 16 in. diameter. The piston-rods, crossheads, and connecting-rods are also of forged steel, while the main crank-bearing and foundation frames, together with the standards for supporting the cylinders, are of cast steel. The whole of the propeller shafting is made hollow of Whitworth compressed steel. The propellers are four-bladed, and have a diameter of 16 ft. The boilers are oval, twelve in number, arranged athwartships, each boiler being 12 ft. 4 in. wide, 14 ft. 1 in. high, and 9 ft. 11 in. long, having in all thirty-six furnaces. The boilers are fitted with 3432 tubes, 2¾ in. diameter and 7 ft. long. The total area of the heating surface is 20,440 square feet. For working with forced draught there are eight fans, of 5 ft. diameter, each of which is driven by a separate small engine. There are four other fans, of 4 ft. diameter, also driven by separate engines, for ventilating purposes. In all there are no fewer than thirty-two small engines belonging to the main engine

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department. The copper steam and exhaust pipes fitted throughout the vessel are over three-quarters of a mile in length. The screw brackets were cast in steel by Messrs. W. Jessop and Sons, Sheffield. They weigh ten tons each. On her hurricane deck she carries eight quick-firing Hotchkiss 6-pounder guns and four Nordenfelt machine guns, in small projecting towers. On her battery deck are ten broadside 6-in. new type guns, those at the fore and after ends of the battery training round so as to fire if need be through ports made for firing directly fore or aft. There are also on this deck four quick-firing guns and six machine guns, four in towers and two carrying shields on their carriages. In her barbette towers are the two 110-ton guns. There are also four smaller five-barrelled Nordenfelt machine guns, 0·45 in. bore. Her top is designed to carry two machine guns. Torpedoes can be discharged ahead, astern, and abeam. **The Benbow.**

The Benbow is the fourth vessel launched out of the six ships of the Admiral class. The displacement will be, as we have said, 10,000 tons. In the Collingwood the limit was set at a displacement of 9150 tons; the figures were raised to 9700 tons for the Rodney and Howe, and further increased to 10,000 tons for the Camperdown, Anson, and Benbow. The hull of the Benbow is divided into 190 compartments. The belt of side armour at the water-line covers 56·35 per cent. of the water line area. The double bottom is carried beyond the citadel bulkheads in both directions, and further protection is afforded against injury from below by a water-tight platform over the hold throughout the entire length of the ship, and between this and the under-water shot-proof deck are the boilers, engines, and magazines of the big guns. In effect, the method of subdivision is such that from the hold right up to the main deck there are practically three skins. Protection against shot and shell is provided for by a belt of steel-faced compound armour, 18 in. thick and about 150 ft. in length, so placed as to cover the sides amidships to a depth of 5 ft. below the load line, and to a height of 2 ft. 6 in. above the water. Over the part of the vessel so defended against horizontal fire there is also carried an armour deck, built up of two thicknesses of ½-inch plating and one layer of 2 in. thick, making 3 in. in all. At the ends of the citadel the under-water protective deck slopes down to meet the lower edge of the side armour, the mean depth of this deck below water being 3 ft. Below the midship protective deck there is placed over the engines and boilers a light steel splinter deck, ⅜ inch thick, to prevent interference with the forced draught upon which the higher effectiveness of the steaming

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The Benbow.

power depends. Across the ends of the citadel are bulkheads of 18 in. and 16 in. compound armour, and on the upper deck between the sides and the barbettes are screens with armour 6 in. thick, protecting the auxiliary battery from raking fire. The sides of the ship above the upper deck where the broadside batteries are placed are of steel 1 in. thick. When the coal bunkers along the sides of the ship below the armoured deck are filled they oppose a thickness of about 9 ft. of coal to the passage of shot. Between these and the outer skin of the ship are wing passages 6 ft. wide, and along the inner wall—on the outer sides of the coal bunkers, that is to say—will hang voluminous folds of thick canvas, which, if the sides were penetrated, would be pressed against the hole and so reduce the inrush of water. Coal bunkers 21 ft. wide are also carried across the ends of the citadel forward and aft. On the lower deck, in front of the horizontal water chamber—introduced to check the rolling of the ship by the movements of a large weight of water freely flowing from side to side—there are four deep watertight tanks, of 15 ft. in length, to hold the ship's cables. The two barbettes each cover a space on the upper deck about 45 ft. in width by 60 ft. in length, the base in plan being, roughly speaking, pear-shaped, to allow room for loading the guns. They are covered with steel-faced armour of a normal thickness of 14 in. on the exposed parts, where the slope practically increases the thickness of the portion which might be struck by direct horizontal fire, and 12 in. thick in the rear. An armoured shaft, or ammunition trunk, as it is technically called, 10 feet in diameter, covered with iron plates 12 in. thick, provides for the safe lifting of the powder and shot from the magazines below to within each barbette. The lift, conveniently fitted to receive at top the projectile, weighing about 1800 lbs., and, in two half cases, the battering charge of 900 lbs. of powder is drawn up by a steel rope worked by specially devised hydraulic machinery, and while the gunners are loading the gun the magazine detachment below are getting the next round into position at the foot of the ammunition tube. The top of the shaft, which is a rectangle of 6 ft. 6 in. by 4 ft., is covered by an armoured hinged scuttle, and when this lid top, as it may be called, is raised, supplies of ammunition and shot can be expeditiously lowered direct to the magazines — a matter of much importance when such heavy weights have to be dealt with. Another point worth mention is an arrangement by which the upcast draught for the ventilation of the ship passes through the barbettes, so as to help to clear the interior space as quickly as possible of smoke.

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The Benbow.

For the protection of the officers navigating the ship and the steersman there is a rectangular conning tower, covered with 14 in. armour and measuring inside 8 ft. by 5 ft. 6 in., placed at the rear of the forward barbette, where the steam steering gear and means of communication by mechanical contrivances and speaking tubes with all parts of the ship are enclosed. On the spar deck, in addition to seven ordinary ships' boats, the Benbow will carry a second-class torpedo boat, a 48-ft. steam picket boat, a 37-ft. steam pinnace, and a 42-ft. launch. A speed of 16 knots is estimated for, but this will probably be exceeded, judging from the performance of the other ships of the Admiral class. The coal complement is 900 tons, but the fuel-carrying capacity is really 1200 tons. The draught of the ship will be, forward 26 ft. 3 in., aft 27 ft. 3 in. The Benbow will carry a crew of 430 officers and men. There is no ship afloat which will carry such heavy guns, or any guns approaching them in weight, on a safer hull.

(3.) CAMPERDOWN.

(Chiefly from the *Times*.)

The Camperdown.

The Camperdown, laid down at Portsmouth, belongs to the group of armourclads, which have been termed the Admiral class. She will be similar to, but slightly larger than, the Collingwood, Rodney, and Howe, and is a sister-ship to the Anson and Benbow.

The following comparisons are not without significance:—

—	CAMPERDOWN.	COLOSSUS.	INFLEXIBLE.
Length	330 ft.	325 ft.	320 ft.
Breadth, extreme	68 ft. 6 in.	68 ft.	75 ft.
Displacement	10,000	9,160	11,880
Draught Forward	26 ft. 3 in.	25 ft. 3 in.	24 ft. 6 in.
Draught Aft	27 ft. 3 in.	26 ft. 3 in.	26 ft. 6 in.
Draught Mean	26 ft. 9 in.	25 ft. 9 in.	25 ft. 6 in.
I.H.P.	9,500	6,750	8,000
Estimated speed	17 knots.	16 knots	14 knots
Principal armament	4 68-ton B.L.R.	4 43-ton B.L.R.	4 81-ton M.L.R.
Citadel armour	18 in. compound	18 in. compound	24 in. iron

The Camperdown is a twin-screw mastless ship, built as usual on the longitudinal system. The double bottom extends for about 156 ft. amidships, and is subdivided by water-tight transverse frames placed 20 ft. apart, as well as by the vertical keel and third longitudinal. The inner bottom above this longitudinal is formed by the wing-passage bulkheads on each side of the ship.

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The Camperdown.

Three other bulkheads, which run in a longitudinal direction, separate the space between the wing-passage bulkheads into machinery and coal-bunker compartments, the coal thus affording protection to the motive power. The protecting armour will consist of a belt at the water-line 150 ft. long and 7½ ft. deep, of which 5 ft. will be under water. The plates will be of compound armour—that is, iron faced with steel—18 in. thick for a depth of 4 ft. from the upper edge, and from thence tapering to 8 in. The armour will be supported by a backing of teak 15 in. thick at the thinnest part. At each end of this belt, and extending across ship, is an armoured bulkhead. This will be of the same depth as the side armour, but will be 16 in. thick at the upper part, tapering to 7 in. at the lower part, while the backing at its thinnest part will be 12 in. This central portion of the ship will contain the propelling machinery, and may be considered as completely protected from the ordinary projectiles of an enemy. Between the armour bulkheads, and at their upper level, the main deck is to consist of three-inch armour. Before and abaft the armoured bulkheads there will be an armoured deck at the level of the lower edge of the belt, consisting of two thicknesses of ½ in. plating overlaid by 1½ in. plating. This under-water deck will afford protection to the steering gear, magazines, shellrooms, &c., as well as ensure a large amount of buoyancy and stability against injury by projectiles fired from guns. A considerable gain in protection is also secured by sloping this armoured deck athwartships. At the fore end it is also made to dip down, and to form with the stem a very powerful ram, which is further strengthened by the bow plating on the ship's side, which is formed of two armour plates. The greater portion of the remainder of the vessel above the armoured decks, with the exception of the screen bulkheads, is unprotected by armour, as no serious injury would accrue to the ship were these penetrable parts to be riddled by shell fire. To prevent, however, as much as possible, the loss of stability which would take place in these circumstances, the spaces are intended to be filled with coal, patent fuel, water-tanks, and other stores. Standing upon and leading up from the main deck within the armour belt are two armoured tubes, about 15 feet in diameter, for purposes of ventilation when in action, and for the passage of ammunition to the large guns. These tubes are covered with steel-faced armour plates 12 in. thick. The upper ends of the tubes are within the two barbettes, which form a distinctive feature of the ship. They are pear-shaped in plan, and each is to contain a couple of 68-ton breech-loading guns revolving on turntables. This arrangement will enable the guns, after firing, to

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be brought into the fore and aft line with their breeches towards the middle of the ship, and coming immediately over the top of the armoured tube in readiness to receive the fresh charge from below. Instead of being curved, as in the ordinary turret, the steel-faced armour-plates for the barbettes will have plain surfaces. A series of angles will consequently be formed at every junction of the plates, which also will be sloped inwards, after the manner of a glacis, at an angle of 60 deg. to the horizontal. The armour will have a normal thickness of 14 in., except at the parts nearest the centre of the ship, which are 12 in. thick. These latter, however, will be to a certain extent protected by the fellow-barbette, by the plating of the ship's side, and by the obliquity of the angle offered to the enemy's fire. The backing here is of 13 in. teak. Extending obliquely across the deck from the barbettes to the sides of the ship are screen bulkheads formed of steel-faced plates 6 in. thick, backed by teak 10 in. thick. These screens form the fore and after bulkheads of that portion of the deck which encloses the six 6-inch breech-loading rifled guns, and prevent their being damaged by a raking fire. The guns have in front of them only the thin sides of the ship, which are composed of two thicknesses of ½-inch steel plates. These guns with their crews will be separated from each other by transverse bulkheads, or splinter screens of plating. By this arrangement the guns could be loaded and laid beforehand, ready to be fired by electricity without their crews being exposed. Standing above the afterpart of the foremost barbette is the armoured conning tower for the officer in command during action, protected by plates 14 in. in thickness, and further strengthened against projectiles by 10 in. of teak backing. In addition to the four 68-ton guns in the barbettes, the Camperdown will also carry six 6-in. breech-loading rifled guns on the broadside above the upper deck, fifteen quick-firing guns and ten machine guns.

The Camperdown.

(4.) Gun-Trials of the Collingwood in March 1885.

The 43-ton breech-loading rifled-gun (Mark II.) is steel, which has made it possible to combine endurance and severe powder-pressures with comparative lightness. It measures 27 ft. 4 in. in extreme length, and gradually tapers from a diameter of 4 ft. 7 in. at the breech through a succession of lessening coils to 17 in. near the muzzle, which possesses what artillerists call a tulip. The bore is 12 in., so that the thickness of the metal at the smallest diameter of the chase is only 2½ in. It is chambered to the extent of 6 ft. 3 in., the powder-space having a diameter of 16 in. When the gun was first designed, it was contem-

The gun-trials of the Collingwood.

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The gun-trials of the Collingwood.

plated using a battering charge (or rather a full charge, as the term "battering" has ceased to be applied to breech-loaders) of 400 lbs. with Palliser and common shell, and shrapnel, weighing each 714 lbs., and with case-shot weighing 724 lbs. But while the weight of the projectiles has been allowed to remain unchanged, it was found that the enormous powder-charge produced very severe strains in the gun, so that it is probable that the full charge finally used will not exceed 295 lbs. It may even be further reduced, but this will depend upon the nature of the slow-burning powder which will be adopted for large guns. With a 260-lb. charge, it has been ascertained that the gun has a muzzle velocity of 1770 ft. per second, and a penetration of 19 in. of soft iron at 1000 yards, and that with a charge of 360 lbs. its muzzle velocity is increased to 2000 ft. and its penetration at the same range to 22 in. The powder, which is stowed in the magazines in brass cylindrical cases, is brought to the foot of the ammunition hoists, where it is taken from the case and placed on the lift, forming a second tier, below the shell, on the same lift, and is then brought to the guns in the barbette through a thick armoured tube. Bollards rotated by hydraulic engines are employed for the purpose of lifting the powder and shell from the magazines and shell-rooms, the burdens being afterwards conveyed to the lifts by runners on overhead rails. It must have been evident to every one who witnessed the firing in the Collingwood, that whatever practical advantages the breech-loading system, as applied to heavy guns, may possess over the obsolete muzzle-loading system, it has necessitated not only a variety of complications in the gun itself, but a still greater number of complications in the accessory fittings and contrivances for controlling the mechanism of the gun. With the 80-ton guns of the Inflexible, for instance, the work of loading was comparatively easy and simple. The monster tubes were slowly rotated to the loading position, their muzzles depressed under the cover of the citadel, and the powder and shell rammed home without more ado. But with the modern gun a distinctly new and aggravating factor comes into force. This is the breech mechanism. The breech-screw has to be released from the lands and the breech-piece withdrawn and disposed of before the operations of loading can be begun. Then a semi-tube has to be inserted in the breech in order to prevent the projectile injuring the threads of the screw, after which the shell and powder are introduced by repeated thrusts of the rammer, for the limited space within the armoured tube is such that it is necessary to push the projectile and the charge separately into the breech, as each is successively raised and secured at the proper elevation in a plane with the axis of the

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gun, which is depressed at the moment to an angle of 13 degrees below the horizontal. Then the entire performance is required to be reversed. The protecting tube is withdrawn, the breech-piece is carried to the breech, run in, and secured by the sixth of a turn, and locked, when the gun is ready to be forced up the inclined slides, laid, and discharged. The first operation of loading is the removal of the breech-piece. This is a ponderous cylindrical steel casting about 3 ft. in length, and encircled by a succession of interrupted threads. The head is circular, and a little behind, at what may be called the shoulder, is the "obturator," which is confined between two steel rings. The obturator is nothing more than a flexible packing of asbestos, which expands under the force of the powder, and by pressing against the surface of the chamber prevents the escape of the vital gases. The removal of the heavy breech-piece is accomplished by an exceedingly ingenious application of hydraulic mechanics. A tray, mounted on a movable table, is pushed laterally towards the axis of the gun, and in the course of its travel it collides against the lever actuating the breech-screw and forces it into a slot whereby it is secured, whereupon a piston or extractor situated at the rear in the same vertical plane as the gun, but below it, recoils, carrying the breech-piece with it. The gun is now prepared for loading, and this is what takes place. The table carrying the screw retraces its lateral journey, closely followed by a second table bearing the protecting tube already referred to. Then, by means of hand-wheel, and screw-gearing, the tube is pushed forward into the breech over the threads, after which hydraulic power is applied to raise the projectile on the lift to the requisite height, when it is thrust into the gun by the rammer. On the rammer being withdrawn, the lift is again elevated until the powder charge is brought into position, when a second thrust completes the loading. The movements are then repeated in reverse order until the breech-piece is run in, screwed into place, and locked, whereupon the gun is run to the front of the slide and elevated, as may be required, the turntable being at the same time rotated, so that the gun may be laid on the object.

The gun-trials of the Collingwood.

Twenty-four rounds were fired in all, in singles and pairs, exclusive of the scaling charges. Half charges, three-quarter charges, and full charges of the new slow-burning and comparatively smokeless cocoa powder were fired, the full charge weighing 295 lbs. The projectiles used were common shell filled with water, and weighing 714 lbs. The cartridges were made up into quarter charges, weighing 73 lbs. 12 ozs. Of this 2¼ lbs. was the black ordinary prism powder, which is equally distributed at each end of the quarter charge for the purpose of

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The gun-trials of the Collingwood.

facilitating ignition, as the Westphalian cocoa prisms, though perforated their entire length, are somewhat difficult to ignite alone. Each fraction of the charge is a foot in length, so that the full charge occupied a space in the gun equal to 4 ft. The projectile is 3 ft. 1 in. in length. The hydraulic power for actuating the gun-gear was set at 750 lbs. to the square inch, while all the relief valves were set at 1500 lbs. The first rounds fired were two half charges from the right and left guns, respectively upon the port and starboard beams, and horizontally, the recoil upon the slides being 15 in. and 14 in. These rounds and the scaling charges were fired by means of electric tubes, composed of platinum wires, gun-cotton, and meal powder. But, in consequence of repeated miss-fires, resort was subsequently had to percussion tubes, exploded by pulling upon a lanyard. With three-quarter charges, fired under the same conditions as before, the recoils rose to 23 in. and 28½ in. Simultaneous discharges delivered horizontally right ahead with three-quarter charges gave a recoil of 27½ in. Rounds from the right gun on the port quarter and from the left gun on the starboard quarter, the former with 2° of depression and the latter with an extreme depression of 5°, produced recoils of 30 in. and 22½ in., three-quarter charges being used in each case. Simultaneous rounds direct ahead, with the same powder charge, but with an extreme elevation of 13°, showed a recoil of 35 in. and 34 in., the greatest hitherto recorded. The 17th and 18th and the 19th and 20th rounds were intended to have been fired in pairs, with full charges, the former with 2° of depression on the starboard and the latter with extreme depression on the port beam. It was found, however, that in one instance the projectile of the right gun, and in another instance the projectile in the left gun, stuck in the grooves, so that with a full charge the breech-block could not be pushed into the guns. The full charges were consequently withdrawn, and three-quarter charges introduced to blow out the shell. The difference in the recoils of the two guns fired together under these different conditions of loading was as 42 in. to 26 in. The remaining rounds were fired while the turntable was rotating. The simultaneous discharge of the guns with extreme elevation produced the largest recoils of the day—namely, 49 in. and 47½ in. Single rounds fired horizontally gave recoils of 47 in. by the right and 42 in. by the left gun. The rotation of the turntable was stopped dead at the moment of the strain, but immediately recovered after the shock.

The guns and the hydraulic gear worked substantially without a hitch from beginning to end. The only mishap was the giving out of the exhaust valve of one of the presses under the concussion of the penultimate round. This did not, however, interfere with the firing,

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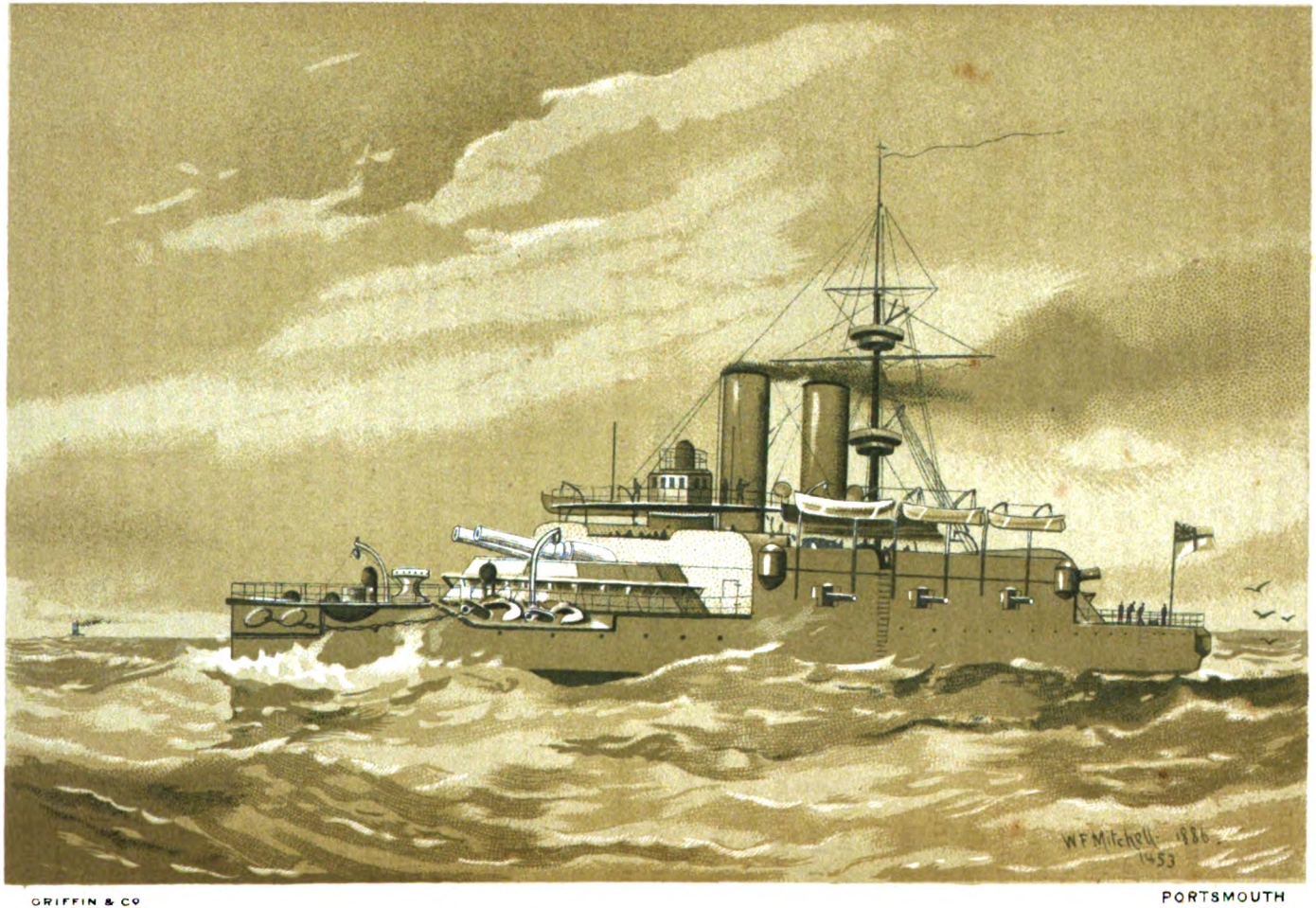

GRIFFIN & Co

PORTSMOUTH

H.M.S. COLLINGWOOD.

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The gun-trials of the Collingwood.

the exhaust being made into the barbette instead of into the reservoir. The pressures in the gun chambers were found light and constant. These were registered by crusher gauges fixed at the end of the cartridges. The full charges exerted a pressure equal to 13·7 tons to the square inch, the three-quarter charges giving a pressure of 9 tons. The mechanism was also easily managed. Although the machinery was new and the gun's crew unaccustomed to it, and it was, moreover, necessary to extemporize ordinary ship's hose-pipes to wash the breech, the guns were worked from fire to run up for firing in four minutes, inclusive of the time absorbed in fixing the crusher gauges. The barbettes were also found to have resisted the strains in a very satisfactory manner. Under a full charge fired from the right gun, with 2° of depression on the port beam, the swing round was found to be only 4 in. This was the greatest derangement recorded, the deflection in the other rounds not exceeding at any time a couple of inches. The jump of the entire fabric under the shock of both guns never exceeded an inch. There were no weaknesses manifested in the ship, notwithstanding that in some instances the guns were trained close to the bulkhead screens.

Note.—Similar guns in the after barbette of Collingwood have been since tested, and one of them burst when fired with a charge of powder of about two-thirds the weight of that used in the trials of the guns in the fore barbette described in the foregoing article.

(5.) Speed-trials of the Collingwood, May 1884.

The speed-trials of the Collingwood.

Each set of engines has one high-pressure cylinder 52 in. in diameter, and two low-pressure cylinders 74 in. in diameter, with a stroke of 3 ft. 6 in. The general design is almost identical with that of the engines of the Edinburgh. There are, however, certain additions of the highest importance. The Collingwood is provided with forced draught fittings, which will enable the indicated horse-power to be largely augmented whenever required, with a corresponding increase in the speed of the ship. Crank-shafts forged of fluid-compressed steel have also been introduced in the place of those of wrought-iron, which have hitherto been fitted. The boilers, twelve in number, have been tested up to 180 lbs. on the inch, and are designed to work at a pressure of 90 lbs. on the square inch. They are arranged in four separate stokeholes, divided by longitudinal and transverse bulkheads. Having in view the greater strain on the tubes by the forced draught, they have been made of iron instead of brass, and separate double-feed engines are fitted in each stokehole, whereby the engineer in charge is enabled to have the whole of the feed arrangements under his own control.

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The speed-trials of the Collingwood.

The engines were at first tested at the comparatively low speeds of eight and ten knots—speeds which will be generally observed during a commission, except upon special occasions. The draught of the ship on this and subsequent trials was 22 ft. 9 in. forward and 24 ft. 3 in. aft, giving a mean draught of 23 ft. 6 in., with amidship section of 1,330 square feet, and a displacement of 8060 tons. Four runs only on the measured mile in Stokes Bay were made at eight knots, but at ten knots the engines were kept continuously working for four hours. The mean results were as follow :—

	8 Knots.	10 Knots.
Steam in boilers	65·62	80·46
Vacuum :—		
Starboard—Forward	28·50	28·50
„ Aft	28·18	28·25
Port—Forward	28·62	28·75
„ Aft	28·75	28·59
Revolutions :—Starboard	41·85	52·40
„ Port	40·77	51·53
Mean pressures :—		
Starboard—High	12·32	17·90
„ Low	2·31	3·74
Port—High	11·10	19·18
„ Low	2·49	3·99
Indicated Horse-power :—Starboard	408·89	781·08
„ „ „ Port	389·81	821·44
Collective I.H.P.	798·70	1,602·33
Consumption of coal per hour	Not taken	1·79 lb.

On subsequent days the ship was driven at 3000 and at 7000 indicated horse-power, the latter being the contract power as defined by the Admiralty when the ship was designed. The vessel was steamed for four hours under each condition, with the appended results :—

	3000 I.H.P.	7000 I.H.P.
Steam in boilers	80·71	87·50
Vacuum :—		
Starboard—Forward	28·37	28·21
„ Aft	28·18	28·37
Port—Forward	28·87	28·37
„ Aft	28·50	28·21
Revolutions—Starboard	66·06	84·52
„ Port	64·88	83·78
Mean pressures :—		
Starboard—High	25·33	44·92
„ Low	6·20	11·40
Port—High	26·88	44·36
„ Low	6·48	12·31
Indicated Horse-power :—Starboard	1,502·33	3,471·56
„ „ „ Port	1,553·55	3,557·14
Collective I.H.P.	3,055·88	7,028·70
Consumption per hour	1·84 lb.	2·09 lbs.
Speed of ship	12.62	16·05

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The final trials consisted of the contractors' trial (for six hours), during which the ship was forced at its utmost power under natural draught, and without the use of the blast; and a three hours' spin with closed stokeholes and forced draught, at a pressure equal to an inch of water. The speed-trials of the Collingwood.

The following Table gives the data obtained:—

	Natural Draught.	Forced Draught.
Steam in boilers	90·25	93·75
Vacuum:—		
Starboard—Forward	28·14	28·00
„ Aft	28·04	28·00
Port—Forward	28·29	27·85
„ Aft	28·33	27·91
Revolutions—Starboard	89·00	95·40
„ Port	86·85	94·84
Mean pressures:—		
Starboard—High	49·93	56·93
„ Low	12·79	14·08
Port—High	50·20	55·68
„ Low	12·96	13·17
Indicated Horse-power:—		
Starboard—High	2,002·34	2,447·00
„ Low	2,078·22	2,451·70
Port—High	1,964·69	2,379·00
„ Low	2,054·58	2,280·50
Collective Indicated Horse-power	8,369·00	9,573·00
Speed of Ship, knots	16·602	16·844
Consumption per hour	2·16 lbs.	2 71 lbs.

The results were eminently satisfactory as regards power developed, speed of ship, and the economical consumption of fuel per unit of power per hour. The engines also worked without a hitch. Though the speed realised by the ship was greater than has ever yet been realised by any similar armour-clad, and was probably greater than she will ever attain again, the experience gained from the trial will probably tend to accelerate the speed of subsequent ships of the type. There can be little doubt that the diameter of the blades of her propellers was too great, and that much of the power of the engines was wasted in consequence. The diameter is 18 ft. 6 in.; and at the number of revolutions of the engines recorded at the final trial the tips of the blades would cut circumferentially through the water at a rate of about a mile and a half a minute, or considerably in excess of the Flying Scotchman express. After the six hours' trial the pitch was fined from 19 ft. to 17 feet 6 in., with a view of enabling the engines to use all the steam generated under forced draught. At the last trial, however, there was still steam passing through the safety valves which the engines could not utilise.

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(6.) Speed-trials of the Colossus in January, 1884.

The speed-trials of the Colossus.

The following Table gives the results of each separate half-hour throughout the trial, with the official means of the last five hours.

The total of the horse-power indicated was made up of 3,732·65 horses from the starboard and 3,755·43 horses from the port engine. The mean vacuum was 27·7 inches. The consumption of fuel during the trial amounted to 2·55 lbs. per unit of power. At this rate of consumption the Colossus has sufficient bunker capacity to enable her to steam at full power for six days consecutively, representing 2343 knots. The total distance covered throughout the run was 90 miles, and the main speed realised was 16·53 knots an hour.—*Times.*

Boiler Pressure.	Revolutions.		Mean Pressures.				Indicated Horse-power.
	Star.	Port.	Starboard.		Port.		
			High.	Low.	High.	Low.	
60	88·56	89·43	40·4	12 9	39·5	12·97	7,601·04
63½	89·6	89·73	39·2	12·6	40·8	12·85	7,599·35
61½	90·0	90·36	41·7	12·4	40·6	12·37	7,385·09
63½	89·5	90·5	42·0	12·6	41·9	12·6	7,772·20
60¼	89·13	89·8	39·8	12·0	39·2	12·0	7,315·87
63½	89·8	90·7	42·0	12·6	42·1	12·47	7,783·25
60¼	89·23	90·0	39·2	11·77	40·3	11·62	7,259·07
59¾	92·3	88·9	39·6	12·0	41·6	11·9	7,495·69
59¾	88·88	89·26	37·9	11·3	40·3	11·35	7,040·03
61¾	90·1	90·43	40·6	12·5	40·5	12·22	7,536·64
61½	89·40	89·86	39·4	11·70	40·7	11·35	7,236·53
62¾	88·86	89·93	40·8	12·55	41·8	12·10	7,573·50
62	93·03	89·76	41·1	12·45	40·9	12·12	7,870·09
61·52	90·02	89·91	40·24	12·11	40·92	11·97	7,488·23

(7.) The Gun-trials of the Colossus in July, 1885.

(From the *Times*.)

The gun-trials of the Colossus.

The system of loading is quite novel, and had not previously been tried in any other ship. Instead of the projectiles and powder being brought up to the gun through an armoured tube and driven home by repeated thrusts of the rammer, they are conveyed from the magazines by overhanging rails and turntables to a hydraulic lift inside the citadel. On being transferred to the armoured deck they are taken by the same system of overhead carriage to the loading

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points, and are forced into the breech by hydraulic rammers, which are hinged into troughs and are covered by the deck itself when not in action. The rammers fall after the shot has been introduced into the gun, so as to allow of the charge being brought into position.

The gun-trials of the Colossus.

The operations began with the trial of the machine and quick-firing guns, one full hopper or holder of 40 rounds being discharged from each of the former and five rounds from each of the latter with ball and case shot. The 6-in. breech-loaders were next tested, a reduced charge of 21 lbs. and a full charge of 41 lbs. being fired from each gun, projectiles and case shot weighing 100 lbs. being used. The report from these auxiliary guns was even more distressing to the ear than the heavy deliveries from the turret guns, and inflicted more damage upon the incandescent lamps (the only injuries sustained during the day). The effect of the firing was very curious, as the imperfectly consumed particles of powder flew through the air like sky-rockets. The density of the smoke was also great considering the comparatively small charges adopted. The whole of these preliminary trials passed off with great success, the range of the guns being good and the behaviour of the mountings all that could be desired. The trials of the guns in the fore turret were afterwards begun. Four reduced charges of 221½ lbs. and six full charges of 295 lbs. of brown prismatic powder were fired from each gun during the day at various bearings and elevations, exclusive of the scaling charges which were fired for the purpose of clearing the guns. The projectiles used for the 43-ton guns were common shells weighted up to 714 lbs. The pressure upon the recoil presses was equal to 1550 lbs., while the pressure upon the elevated presses was equal to 1300 lbs. to the square inch. Not the slightest hitch occurred to the hydraulic machinery from first to last. Two rounds were fired horizontally on the port beam, two 45° before and 45° abaft the port beam, with 3° of elevation; two on the starboard beam with 5° and 3° of elevation respectively, and simultaneous rounds from the two guns on the port beam with extreme elevation. These were all with reduced charges. With full charges two rounds were fired horizontally, and two with extreme depression on the port beam, two 60° abaft and 60° before the port beam respectively, with 3° of elevation, two on the starboard beam with 5° and 3° of elevation, two fired simultaneously with 5° of elevation, 45° before the port beam, and two fired simultaneously with extreme elevation, 45° abaft the port beam. Some of the rounds were fired with the turret stationary, and others (including double discharges) with the turrets moving slowly to the right. The positions and

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The gun-trials of the Colossus.

elevations were well chosen to subject the mountings to a crucial ordeal, and to ascertain the effect of the blow of the concussion upon the turret rollers and roller-ways. But they cannot be taken to represent the strains which the weather deck and superstructures would be subjected to in action. The superstructures are light erections built along the middle line in wake of the guns, and, as a matter of fact, constitute the dead points which have to be guarded against. Their situation is such as to make them feel the full effect of rounds directed before and abaft the beam, to say nothing of rounds fired either direct ahead or astern. It will also be observed that the rounds directed across the deck on the starboard beam were fired at considerable elevations, the horizontal rounds being confined to the port side, where they could inflict no damage. The average recoil with the reduced charges was 28 in., and with the full charges 43 in.; the longest recorded being 46 in. under a double discharge with 5° of elevation. The whole of the firing thus far passed off with the greatest success, the highest jump of the deck in the citadel not exceeding $\frac{5}{8}$ in. With the first round from the after turret, however, the locking latch of the left gun had got bent in some way, whereby the breech-piece could not be effectually closed, and before the precise defect could be discovered and remedied, considerable time was lost. With the second round from the right gun the canvas covering of the obturator got torn by some means, and, becoming burred, would not allow of the breech-block being run home, and as daylight had ended by the time a new obturator could be inserted in the mushroom head, it was deemed expedient to suspend the firing.

(8.) The Conqueror's trial under steam in January, 1883.

The Conqueror.

The trial consisted of two parts, the first taking place with the natural draught of the furnaces, while the second was conducted with closed stokeholes and forced draught. The indicated horse-power, sustained for some hours in each case, was measured, and also the speed of the ship, eight runs being taken over the measured mile, four for each condition. The indicated power contracted for was 4500-horses, with natural draught. This was obtained without any difficulty, and gave the ship a mean speed of 14¾ knots. The stoke-holes having been closed in, and an air-pressure maintained in them capable of sustaining a column of one inch and a half of water, the power rose to nearly 6000-horses, and the speed of the ship became

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15½ knots. As the ship is only 270 feet long between the perpendiculars, and as she had at the time of these trials a displacement exceeding 6000 tons, the speed obtained is somewhat remarkable. The ship was steered by steam. The whole of the machinery, both for propelling and steering purposes, worked with great smoothness. A somewhat remarkable feature in the Conqueror consists of a poop which extends as far forward as the funnel stack, and masks the right aft fire from the guns. This feature is not possessed by any other vessel of her class. It has the advantage of enabling her to carry two torpedo boats when desired, besides providing excellent accommodation for the officers and crew, and increasing the capacity of the store-rooms. Another interesting feature in this ship is the pilot tower, which will be placed on the poop deck, and protected with very thick steel-faced armour, and will command an all-round view. In action the ship will be entirely worked and fought from this tower; the guns and torpedoes will be directed and fired from it. The Conqueror.

(9) The Edinburgh's Steam-trials.

(Chiefly from the *Times*.)

The trials began on the 11th of September, 1883, and were continued on the 12th and 13th, at gradually increasing rates of speed. For the purposes of the trials and of the rolling experiments which were subsequently performed on board, the Edinburgh was brought down almost to her load-line by 700 tons of iron ballast in addition to her coal supply. After having first ascertained by a few runs on the measured mile the number of revolutions of the engines per minute required to drive the ship at the particular speed, she was afterwards steamed for four hours at sea, with the object of determining the consumption of fuel per unit of horse-power under each condition. For the low rates of speed only four of the boilers were used. The coal was carefully weighed, and half-hourly diagrams and observations were taken during the runs. The following Table shows the results of the trials on the 11th, 12th, and 13th instant respectively:— The Edinburgh.

Draught, forward	22 ft. 1 in.	22 ft. 0 in.	21 ft. 11 in.
Draught, aft	23 ft. 4 in.	23 ft. 5 in.	23 ft. 5 in.
Steam-pressure	52 lbs.	52 lbs.	55 lbs.
Vacuum	28 in.	28 in.	28 in.
Revolutions	41	51	62
I.H.P.	818·04	1,505	2,542
Speed—knots	8·097	9·849	11,961
Consumption of coal per I.H.P.	2·00 lbs. per hour	2·02 lbs. per hour	1·75 lbs. per hour

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The Edinburgh.

The ship was rolled at Spithead, for the purpose of ascertaining the length of her natural period and the effect of her water-chamber in checking her oscillations. The experiments were conducted by Mr. Froude, of Torquay, Mr. Brunel, Mr. P. Watts, Assistant Constructor at the Admiralty, and Mr. Pledge, Admiralty draughtsman, 700 men being employed to produce the oscillations by running together in line from side to side. The principle has been abundantly established that an increase in the metacentric height of a ship shortens the length of her natural period, and at the same time adds to her stability. Ships of low metacentric height are proverbially slow rollers, and in perfectly protected armourclads, or monitors of the Devastation type, the metacentric height ranges from 2½ to 5 feet. In citadel ships, however, the unprotected ends of which may be shot away or injured by shell-fire, it is necessary to give great metacentric stability. The metacentric height of the Inflexible is as much as 8 feet, while that of the Edinburgh and her class is about 9 feet. These conditions would make them unsteady at sea, and hence it has been necessary to increase their steadiness without lowering their stability. This has been accomplished in two ways: by fitting them with deep bilge keels for the purpose of checking rolling, and with water-chambers for the purpose of prolonging their natural periods. The Edinburgh was first rolled in her fighting condition, when the length of her oscillations was found to be about nine seconds. Forty tons of water were afterwards run into her water-chamber, and she was rolled a second time. The angle of the roll was reduced from 6° to 4½°, and the action of the water tended very materially to check the oscillations. There was a perceptible increase of period noticeable; but, as it is considered necessary to prolong her period to ten seconds, the length of the chamber is to be increased by cutting through the cork spaces and cofferdam at the sides of the ship. On the conclusion of the experiments the ship returned into harbour, and after having re-coaled and had the water in her boilers changed, and the tubes swept, she again went out of harbour for the crucial trial of her engines by six hours' full-power steaming. She got under way shortly before nine. There was no wind, and the sea was perfectly smooth, but the fog lay so thick upon the water that it was for some time doubtful whether it would be expedient to make the trial. Subsequently, however, the fog lifted slightly, though it was never completely dispersed, and the first observations began at twenty minutes past ten. The draught on the occasion was 22 ft. 2 in. forward, and 23 ft. 5 in. aft. After the ship had attained her full

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The Edinburgh.

speed it was found that a remarkable wave was thrown up by the prow, the result of which must have retarded the ship considerably in her progress through the water. Nothing similar in form had been previously noticed during the steaming of any other vessel. The sea being perfectly smooth, the water lay without a curve until it met the stem of the ship, when it suddenly rose like a vertical and solid wall from the normal to the height of about 13 ft., and passed for some distance to the rear unbroken on each side. A second wave, the reflex action of the first, was subsequently formed, but the height was inconsiderable. The breadth of the broken water was singularly small, smaller, in fact, than is usually caused by the way of a gunboat. The absence of vibration in the ship at a time when the engines were exerting their utmost force was another noticeable circumstance connected with the run. It was perceived from an early hour during the trial that with plenty of steam, no signs of hot bearings or priming, and extraordinary smoothness in the action of the machinery, both the estimated speed of the ship (14 knots) and the contract power of the engines (6000 horses) would be greatly exceeded. The data of every half hour told their gratifying tale, and the successful monotony of the trip was unbroken except for a short time during the afternoon, when, through the heating and blistering of the funnel-casing, the deck in the vicinity began to smoulder. All danger, however, was presently removed by the prompt use of the water-service. But as the whole of the uptakes from the ten boilers are led to a single funnel, the heat at the point will always be great, and measures will have to be taken to provide against emergencies. The full-power trial terminated shortly after four o'clock. The following Table gives the result of each half-hour's steaming and the means of the six hours :—

Steam Pressure.	Revolutions.	Vacuum.		Mean Pressures.		Indicated Horse-power.
		Star.	Port.	H.P.	L.P.	
63¾	86·0	26¼	27	33·4	10·5	6,649·34
64¼	87·0	26	26½	32·0	12·0	7,067·23
63¼	88·0	25½	26	27·0	13·0	6,890·39
64¼	88·0	25¾	26¼	27·3	13·0	7,000·28
64¾	88·0	25¾	26½	26·5	13·0	6,930·00
63½	87·5	26½	27	28·0	12·5	6,809·73
63¼	87·2	26½	27	27·3	13·0	6,847·77
62¾	86·6	26½	27	26·8	12·5	6,656·57
64¾	86·5	26½	25¾	27·0	12·5	6,749·41
62¼	86·8	26¼	27	27·0	12·3	6,641·01
62¼	87·0	26¼	27	27·5	12·2	6,686·33
62¼	86·0	26¼	27	28·8	12·2	6,776·60
63¼	87·4	26	26·6	28·2	12·5	6,808·72

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The Edinburgh.

The results show that the performances of the engines were very uniform, and that from beginning to end they executed far beyond their contract power. The mean of the indicated horse-power gives a surplus of over 808 horses over the contract, the highest margin which has yet been developed by any of Her Majesty's ships. The speed realised was also in the highest degree satisfactory. As tested by four runs on the measured mile, the average amounted to 16 knots per hour, or two knots in excess of the estimate. The propellers are four-bladed screws of the Admiralty pattern, each blade having a diameter of 17 ft. 6 in., and a pitch of 18 ft. 6 in.

(10.) The Devastation.

The Devastation.

This ship completed her steam-trials, after her refit, at the back of the Isle of Wight, on July 23rd, 1883, under the superintendence of the officers of the Portsmouth Steam Reserve. After testing her steering powers by describing eight circles with 60 revolutions of the engines, she proceeded on a four hours' full-power trial of her engines. The boilers, which were originally weighted to blow off at 30 lbs., had their pressure reduced to 25 lbs. The mean revolutions during the run were, 67 by the port, and 68 by the starboard engines. The vacuum was unsatisfactory. The average horse-power developed was 4504 horses, and the speed attained, as measured by log, 13·5 knots an hour. The consumption of fuel during the trial was 3·4 lbs. per unit of horse-power per hour.

(11.) Alterations in the Hecate.

The Hecate.

An unarmoured superstructure has been erected upon the upper deck on each side of the breastwork, extending to the vessel's sides, and for a distance of 20 feet abaft the breastwork. In this way the full breadth of the Hecate is now extended up to the top of the breastwork deck, for a length of the vessel of about 120 feet. This will considerably amplify her curve of stability, and increase her maximum righting moment. But this is not all. The space abaft the breastwork above the upper deck is converted into a captain's cabin, and the spaces at the sides have been converted into a reading-room for the officers, a sick bay, &c. This

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gives greater room on the lower deck aft for the officers' rooms, and forward for the crew's mess space. Inconvenience will always be experienced by the officers and seamen of these armour-clad monitors, but the changes made in the Hecate have very much reduced the objections previously entertained towards that vessel and her three sisters. The strength of the unarmoured superstructure was tested on Saturday, the 22nd December, 1883, by firing the four turret guns over it when loaded with full and battering charges. After firing the guns individually and simultaneously, it was found that two rivets only had been started, but that no other damage had been sustained, notwithstanding the severity of the test. The Hecate.

(12.) The Nile and the Trafalgar.

The Nile and Trafalgar are the largest armour-clads yet constructed for the English navy, and they surpass in displacement all foreign armour-clads, except four ships now being constructed for the Italian navy. Their dimensions are: length, 345 feet; breadth, 73 feet; displacement, 11,940 tons; indicated horse-power 12,000. The estimated speed with forced draft is about 16½ knots. There will be an armoured citadel 193 feet long in the central fort of the ship, and at each end of it a turret. Each turret will carry two 68-ton breech-loading guns. Between the turrets, and above the citadel, is a central box battery, with lightly armoured screens to prevent the battery being raked (the armour is five inches thick). This battery will contain eight five-inch breech-loading guns, and on the spar deck covering this battery the boats will be stowed and a number of quick-firing and machine guns mounted. The turret guns will be loaded and worked by hydraulic power, and the turrets will be revolved in the same way. Each ship will have a powerful torpedo armament, and will, as usual, be fitted for ramming. They will be capable of carrying 1200 tons of coal in the bunkers, which will enable them to steam 6500 knots, at a speed of 10 knots, but they will have no rig. The armour belt at the water line extends for a length of 230 feet amidships, tapering in thickness towards the ends; and before and abaft it, extending to the stem and stern, there is a three-inch armoured deck. The maximum thickness of the armour of the belt will be 20 inches, on the sides of the citadel The Nile and the Trafalgar.

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The Nile and the Trafalgar.

18 inches to 16 inches, and on the turret 18 inches. There is also a strong inner skin two inches thick worked behind the backing, as in the Renown and Sans Pareil. The cost of each ship will, with the guns, be not less than £920,000. The hull will cost £686,000, the propelling machinery £97,000, the gun mountings £80,000, and the guns £57,000.

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GREAT BRITAIN.

UNARMOURED SHIPS.

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GREAT BRITAIN.—Unarmoured Cruising Ships, &c.

comp., composite hull; 2 *s.*, two screws; M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; M., machine gun; Q.F., quick-firing gun; l., light guns under 15 cwt., including boats' guns; tu., torpedo-tube or launching carriage; P., deck protected throughout; pp., deck protected amidships. The decks in these cases are at least one inch thick.

Class.	NAME.	Material of Hull.	Displacement.	Indicated Horse-Power.	Draught of Water.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Launch.	Cost.		Armament.		Speed.	Coal Endurance.	
											Hull.	Machinery.	Guns.	Tubes for Torpedoes.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
			Tons.		ft. in.	ft. in.	ft. in.				£	£			knots.	tons.	knots.
Sloop . .	**Acorn** . .	*Comp.*	970	920 forced draught.	14 0	167 0	32 0	Milford Haven	Maudslay.	1884	27,500 estim'td	14,500 estim'td	8 5-in. B.L.R., 1 l., 8 M. .	..	11·00	150	1900
Corvette . .	**Active** . .	Iron, wood and copper sheathed	3080	4130	21 4	270 0	42 0	Blackwall	Humphrys	1869	85,795	40,361	10 6-in. B.L.R., 2 64-pdrs. M.L.R., 2 l., 10 M.	2 tu.	15·00	410	2000
Desp. Vessel .	**Alacrity** (2) 2 *s.*	Steel.	1400	3180	14 0	250 0	32 6	Jarrow .	Palmer .	1885	*x* 48,289	*y* 29,680	4 5-in. B.L.R., 4 Q.F., 2 M.	tu.	17·0	400	6450
Sloop . .	**Albatross** . .	*Comp.*	940	840	14 5	160 0	31 4	Chatham.	Humphrys	1873	28,729	9,697	2 90-cwt. M.L.R., 2 64-pdr. do., 1 l., 4 M.	..	10·51	100	1000
Gun Vessel .	**Algerine** . .	*Comp.*	835	810	13 7	157 0	29 6	Belfast .	Laird .	1880	25,896	10,556	2 64-pr. M.L.R., 2 5-in. B.L.R., 2 M., 1 l.	..	10·50	110	1100
2nd Class Cruiser pp.	**Amphion** (1) 2 *s.*	Steel	3750	5600	20 6	300 0	46 0	Pembroke	Maudslay .	1883	95,000	65,500	10 6-in. B.L.R., 14 M., 2 l. .	4 tu.	17·00	1000	11,000
Gun Vessel .	**Arab** . . .	*Comp.*	720	660	13 9	150 0	28 6	Glasgow .	Napier .	1874	25,041	9,982	1 90-cwt. M.L.R., 1 64-pdr. do., 3 20-pdr. B.L.R., 2 l., 2 M. .	..	10·26	70	790
Torpedo Cruiser.	**Archer** (7) . 2 *s.*	Steel	1630	4000	13 6	225 0	36 0	Glasgow .	Thomson .	1886	*x* 55,916	*y* 31,667	6 6-in. B.L.R , 8 2-F., 2 M., 1 l.	8 tu.	17·00	475	7000
2nd Class Cruiser pp.	**Arethusa** (3) 2 *s.*	Steel	3750	5600	20 6	300 0	46 0	Glasgow .	Napier .	1882	86,763	58,435	10 6-in. B.L.R., 14 M., 2 l. .	4 tu.	17·00	1000	11,000
Gun Vessel .	**Avon** . 2 *s.*	*Comp.*	603	530	9 7	155 0	25 0	Portsm'th	Maudslay .	1867	16,547	5,797	1 6½-ton M.L.R., 1 64-pdr. do., 2 20-pdr. do., 2 M.	..	10·34	90	—
Corvette . .	**Bacchante** . .	Iron, wood and zinc sheathed	4130	5420	23 9	280 0	45 6	Portsm'th	Rennie .	1876	152,454	76,954	10 90-cwt. M.L.R., 4 6-in. B.L.R., 8 l., 8 M.	2 tu.	15·06	570	4070
Gun Vessel .	**Bittern** . 2 *s.*	Wood	805	850	10 1	170 0	29 0	Pembroke	Avonside Co.	1869	17,005	6,731	1 90-cwt. M.L.R., 2 40-pdr. B.L.R., 1 l., 2 M.	..	10·7	110	740
Corvette . .	**Boadicea** . .	Iron, wood and copper sheathed	4140	5130	23 8	280 0	45 0	Portsm'th	Rennie .	1875	153,167	70,409	12 6-in. B.L.R., 4 5-in. do., 2 l., 4 Q.F., 8 M.	3 tu.	14·70	570	3000

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Torpedo Cruiser.	**Brisk.**	2 *s.*	Steel	1630	4000	13	6	225	0	36	0	Glasgow .	Thomson .	1886	55,916	31,667	6	6-in. B.L.R., 8 Q.F., 2 M., 1 l.	8 tu.	17·00	475	7000
Corvette . .	**Briton** .	.	Wood	1860	2150	17	1	220	0	36	0	Sheerness	Rennie .	1869	39,299	21,356	14	64-pdr. M.L.R., 2 l., 6 M. .	..	13·13	250	2664
Gun Vessel .	**Buzzard** .	2 *s.*	*Comp.*	1040	1500	11	6	195	0	28	0	Sheerness	..	86/7	*x* 45,000 estim'td	*y* 15,000 estim'td	8	5-in B.L.R. guns, 8 M. .	— ..	13·50 estd.	280	5000
Corvette, pp. .	**Calliope** .	.	Steel & wood & copper sheathed	2770	3000	19	11	235	0	44	6	Portsm'th	Rennie .	1884	82,000	38,000	4	6-in. B.L.R., 12 5-in. do., 10 M., 2 l.	2 tu. ..	13·75	550	4000
„ „ .	**Calypso** .	.	Steel & Do.	2770	3000	19	11	235	0	44	6	Chatham	Rennie .	1883	82,000	37,500	4	6-in. B.L.R., 12 5-in. do., 10 M., 2 l.	..	13·75	550	4000
„ „ .	**Canada** .	.	Steel & Do.	2380	2430	19	1	225	0	44	6	Portsm'th	Rennie .	1881	78,000 estim'td	26,500 estim'td	10	6-in. B.L.R., 6 M., 2 l. .	2 tu.	13·00	470	5400
„ „ .	**Caroline** .	.	*Comp.*	1420	1440	15	9	200	0	38	0	Sheerness	Maudslay .	1882	56,000 estim'td	15,000 estim'td	14	5-in. B.L.R., 8 M., 1 l. .	..	13·00	400	6400
„ „ .	**Carysfort** .	.	Steel & wood & copper sheathed	2380	2403	19	0	225	0	44	6	Glasgow .	Elder .	1878	84,512	29,942	2	90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	..	12·96	470	3840
„ „ .	**Champion** .	.	Steel & Do.	2380	2340	19	2	225	0	44	6	Glasgow .	Elder .	1878	84,288	29,695	2	90-cwt. M.L.R., 12 64-pdr. do., 7 M., 2 l.	..	13·00	470	3840
„ „ .	**Cleopatra** .	.	Steel & Do.	2380	2610	19	3	225	0	44	6	Glasgow .	Humphrys	1878	86,126	27,798	2	90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	..	13·00	470	3280
„ „ .	**Comus** .	.	Steel & Do.	2380	2450	19	3	225	0	44	6	Glasgow .	Elder .	1878	84,497	29,477	4	6-in. B.L.R., 8 64-pdr. M.L.R., 8 M., 2 l.	2 tu.	12·93	470	3800
Gun Vessel .	**Condor** .	.	*Comp.*	780	770	13	2	157	0	29	6	Dev'nport	Elder .	1876	25,356	9,232	1	90-cwt. M.L.R, 2 64-pdr. do., 1 l., 2 M.	..	10·90	130	1170
Corvette, pp. .	**Conquest** .	.	Steel & wood & copper sheathed	2380	2670	18	6	225	0	44	6	Glasgow .	Humphrys	1878	83,707	27,205	2	90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	2 tu.	13·00	470	3280
„ „ .	**Constance** .	.	Steel & Do.	2380	2590	19	2	225	0	44	6	Chatham .	Penn .	1880	78,000 estim'td	32,000 estim'td	2	90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	2 tu.	13·72	470	5000
„ „ .	**Cordelia** .	.	Steel & Do.	2380	2420	19	1	225	0	44	6	Portsm'th	Rennie .	1881	78,000 estim'td	26,500 estim'td	10	6-in B.L.R., 10 M., 2 l. .	2 tu.	13·00	470	5400
Sloop . .	**Cormorant**	.	*Comp.*	1130	950	15	3	170	0	36	0	Chatham .	Humphrys	1877	37,630 *x*	11,587 *y*	2	90-cwt. M.L.R., 4 64-cwt., 64-pdr. M.L.R., 1 l., 6 M.	..	11·31	150	1500
Torpedo Cruiser	**Cossack** .	2 *s.*	Steel	1630	4000	13	6	225	0	36	0	Glasgow .	Thomson .	1886	55,916 *x*	31,667 *y*	6	6-in. B.L.R., 1 l., 8 Q.F., 2 M.	8 tu.	17·00	475	7000
Corvette, pp. .	**Curaçoa** .	.	Steel & wood & copper sheathed	2380	2540	18	10	225	0	44	6	Glasgow .	Humphrys	1878	85,833 *x*	27,098 *y*	2	90-cwt. M.L.R., 12 64-pdr. do., 2 l., 6 M.	..	13·00	470	3280
Gun and Torpedo Vessel . .	**Curlew** (8) .	2 *s.*	Steel	790	1200	10	6	195	0	28	0	Devonp'rt	Penn .	1886	37,363 *x*	12,600 *y*	1	6-in. B.L.R., 3 5-in. B.L.R., 7 M.	5 tu.	15·00	250	10,000
Sloop . .	**Daring** .	.	*Comp.*	940	920	14	7	160	0	31	4	Blackwall	Penn .	1874	30,023	9,590	2	90-cwt. M.L.R.; 2 64-pdr. do., 1 l., 4 M.	..	10·64	100	1000

x Includes Gun Mountings. *y* Propelling Machinery.

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GREAT BRITAIN.—Unarmoured Cruising Ships, &c.—*continued.*

comp., composite hull; 2 *s.*, two screws; M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun: M., machine gun; Q.F., quick-firing gun; l., light guns under 15 cwt., including boats' guns; tu., torpedo-tube or launching carriage; P., deck protected; pp., partial deck protected.

Class.	NAME.	Material of Hull.	Displacement.	Indicated Horse-Power.	Draught of Water.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Launch.	Cost.		Armament.		Speed.	Coal Endurance.	
											Hull.	Machinery.	Guns.	Torpedoes.		Coal that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
			Tons.		ft. in.	ft. in.	ft. in.				£	£			knots.	tons.	knots.
Corvette	Diamond	Wood	1970	2140	18 0	220 0	37 0	Sheerness	Hawthorn	1874	50,607	26,189	12 64-pdr. M.L.R., 2 l., 6 M.	..	12·56	270	2060
„	Dido	Wood	1760	2520	16 4	212 0	36 0	Portsm'th	Humphrys	1869	36,417	19,574	12 64-pdr. M.L.R., 2 l., 6 M.	..	13·50	250	1560
Sloop	Dolphin	*Comp.*	925	720	14 0	157 0	32 0	Middl'sbro	Hawthorn	1882	25,850	9,800	2 6-in. B.L.R., 2 5-in. B.L.R., 1 l., 3 M.	..	10·50	135	1700
„	Dragon	*Comp.*	130	1010	15 6	170 0	36 0	Devonp'rt	Maudslay	1878	36,427	13,069	2 90-cwt. M.L.R., 4 64-pdr. do., 1 l., 4 M.	..	11·52	150	1480
Corvette	Druid	Wood	1860	2270	16 4½	220 0	36 0	Deptford	Maudslay	1869	33,794	22,231	14 64-pdr. M.L.R., 2 l., 6 M.	..	12·90	270	1750
Corvette	Eclipse	Wood	1760	1950	16 4	212 0	36 0	Sheerness	Napier	1867	39,242	24,084	12 64-pdr. M.L.R.	..	12·90	250	1630
Sloop	Egeria	*Comp.*	940	1010	14 3	160 0	31 4	Pembroke	Humphrys	1873	32,468	10,414	2 6-in. B.L.R., 2 5-in. do.	..	11·30	100	1000
Gun Vessel	Elk 2 *s.*	*Comp.*	603	470	8 9	155 0	25 0	Portsm'th	Penn	1868	16,107	5,775	1 90 cwt. M.L.R., 1 64-pdr. M.L.R., 2 20-pdr., 2 M.	..	9·25	100	—
Corvette	Emerald	*Comp.*	2120	2175	19 0	220 0	40 0	Pembroke	Thomson	1876	72,312	26,130	4 6-in B.L.R., 8 5-in. do., 2 l., 7 M.	..	13·20	250	2280
„	Encounter	Wood	1970	2130	17 6	220 0	37 0	Sheerness	Rennie	1873	43,271	19,827	14 64-pdr. M.L.R., 2 l., 6 M.	..	13·19	260	2500
Sloop	Espiegle	*Comp.*	1130	1140	16 3	170 0	36 0	Devonp'rt	Maudslay	1880	37,000 estim'td	11,770 estim'td	2 90-cwt. M.L.R., 4 64-pdr. do., new 10 5-in. B.L.R., 1 l., 6 M.	..	11·5	150	1480
Corvette	Euryalus	Iron, wood and zinc sheathed	4140	5110	23 3	280 0	45 6	Chatham	Easton and Anderson	1877	132,254	76,959	12 6-in. B.L.R., 4 5-in. do., 2 l., 4 Q.F., 8 M.	2 tu.	14·72	550	2080
Gun Vessel	Falcon	*Comp.*	780	720	13 0	157 0	29 6	Birkenh'd	Laird	1877	25,763	10,805	1 90-cwt. M.L.R., 2 64-pdr. do., 1 l., 2 M.	..	10·70	120	1990
Sloop	Fantome	*Comp.*	940	970	14 2	160 0	31 4	Pembroke	Humphrys	1873	30,343	10,197	2 90-cwt. M.L.R., 2 64-pdr. do., 4 M.	..	11·06	100	1000
Torpedo Cruiser	Fearless 2 *s.*	Steel	1430	3200	14 6	220 0	34 3	Barrow	Barrow	1886	*x*60,881	23,250	4 5-in. B.L.R., 8 Q.F., 2 M., 1 l.	11 tu.	17·00	450	6900
Gun Vessel	Flamingo	*Comp.*	780	750	12 11	157 0	29 6	Devonp'rt	Elder	1876	25,774	9,228	1 90-cwt. M.L.R., 2 64-pdr., 1 l., 4 M.	..	11·00	130	1170

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Gun Vessel	Flirt	2 *s.*	*Comp.*	603	530	9	10	155	0	25	0	Devonp'rt	Maudslay	1867	29,444	10,001	1 90-cwt. M.L.R., 1 64-pdr. do., 2 20-pdr. B.L.R., 2 M.	..	9·68	100	—
Sloop	Flying Fish		*Comp.*	940	840	14	2	160	0	31	4	Chatham.	Humphrys	1873	29,444	10,001	2 90-cwt. M.L.R., 2 64-pdr. do.	..	10·96	100	1000
2nd Class Cruiser P.	Forth	2 *s.*	Steel	3550	5700	20	0	300	0	46	0	Pembroke	Hawthorn.	1886	151,952	50,000	2 8-inch B.L.R., 10 6-in. B.L.R., 3 Q.F., 10 M.	..	18·00	730	7400
Gun Vessel	Frolic	2 *s.*	*Comp.*	610	900	9	6	155	0	25	0	Chatham	Penn	1872	16,512	6,593	1 90-cwt. M.L.R., 1 64-pdr. do., 2 20-pdr. B.L.R., 2 M.	..	10·70	80	880
Sloop	Gannet		*Comp.*	1130	1110	15	9	170	0	36	0	Sheerness	Humphrys	1878	39,581	12,889	2 90-cwt. M.L.R., 3 64-pdr. do., 2 5-in. B.L.R., 1 l., 6 M.	..	11·53	150	1480
Corvette	Garnet		*Comp.*	2120	2000	19	7	220	0	40	0	Chatham.	Hawthorn.	1877	64,689	27,779	12 64-pdr. M.L.R., 2 l., 6 M.	..	13·00	260	2000
Gun Vessel	Griffon		*Comp.*	780	790	13	2	157	0	29	6	Birkenh'd	Laird	1876	25,330	10,794	1 90-cwt. M.L.R., 2 64-pdr. do., 1 l., 4 M.	..	10·87	120	1990
Torpedo Depôt Ship.	Hecla		Iron	6400	1760	24	3	391	7	38	9	(Purchased)		..	126,190	..	4 64-pdr. M.L.R., 1 5-in. B.L.R., 1 40-pdr. B.L.R., 8 M.	4 tu.	11·7	22,200	26,400
Corvette, pp.	Heroine		*Comp.*	1420	1470	15	9	200	0	38	0	Devonp'rt	Humphrys.	1881	44,500 estim'td	..	8 6-in. B.L.R., 4 M., 1 l.	..	13·11	400	6000
„ „	Hyacinth		*Comp.*	1420	1470	15	9	200	0	38	0	Devonp'rt	Humphrys.	1881	44,500 estim'td	..	8 6-in. B.L.R., 4 M., 1 l.	..	13·10	400	6000
Sloop	Icarus		*Comp.*	990	1200	13	6	167	0	32	0	Devonp'rt	Barrow	1886	36,000	12,725	8 5-in. B.L.R., 1 l., 8 M.	..	12·5	150	2300
Frigate	Inconstant		Iron, wood and copper sheathed	5780	7360	25	6	337	4	50	3	Pembroke	Penn	1868	138,585	74,739	10 12-ton M.L.R., 6 6½-ton M.L.R., 6 20-pdr. B.L.R., 4 l., 10 M.	2 tu.	16·20	750	2780
Despatch Vessel.	Iris	2 *s.*	Steel	3730	7330	22	0	300	0	46	0	Pembroke	Maudslay	1877	110,868	102,318	2 64-pdr. M.L.R., 4 6-in. B.L.R., 4 5-in. do.	4 tu.	17·98	780	4400
Corvette	Juno		Wood	2240	1380	18	6	200	0	40	4	Deptford.	Humphrys.	1867	51,361	21,108	8 64-pdr. M.L.R., 2 l., 6 M.	..	10·87	230	2220
Sloop	Kingfisher		*Comp.*	1130	1090	15	9	170	0	36	0	Sheerness	Maudslay	1879	39,300 estim'td	11,850 estim'td	2 90-cwt. M.L.R., 4 64-pdr. do., 1 l., 4 M.	..	11·60	150	1480
Gun and Torpedo Vessel.	Landrail (*a*)	2 *s.*	Steel	790	1200	10	6	195	0	28	0	Devonp'rt	Penn	1886	37,363	12,600	1 6-in. B.L.R., 3 5-in. B.L.R., 7 M.	5 tu.	15·0	250	10,000
2nd Class Cruiser, pp.	Leander (*a*)	2 *s.*	Steel	3750	5600	20	6	300	0	46	0	Glasgow	Napier	1882	87,843 estim'td	60,610 estim'td	10 6-in. B.L.R., 12 M., 2 l.	4 tu.	17·00	1000	11,000
Gun Vessel	Lily		*Comp.*	720	830	13	6	150	0	28	6	Glasgow	Napier	1874	24,141	9,967	1 90-cwt. M.L.R., 2 64-cwt. do., 1 l., 2 M.	..	10·60	70	750
„	Linnet	2 *s.*	*Comp.*	756	1050	10	11	165	0	29	0	Blackwall	Rennie	1880	25,281	10,382	2 90-cwt. M.L.R., 3 20-pdr. B.L.R., 2 M.	..	11·80	180	2400
Sloop	Mariner		*Comp.*	970	970	14	0	167	0	32	0	Devonp'rt	Hawthorn.	1884	37,156	12,841	8 5-in. B.L.R., 1 l., 8 M.	..	11·00	150	2300

x Includes Gun Mountings, &c. *y* Propelling Machinery.

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GREAT BRITAIN.—Unarmoured Cruising Ships, &c.—*continued.*

comp., composite hull; 2 *s.*, two screws; M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; M., machine gun; Q.F., quick-firing gun; l., light guns under 15 cwt., including boats' guns; tu., torpedo-tube or launching carriage; P., protected; pp., partial deck protected.

Class.	NAME.	Material of Hull.	Displacement.	Indicated Horse-Power.	Draught of Water.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Launch.	Cost.		Armament.		Speed.	Coal | Endurance.	
											Hull.	Ma-chinery.	Guns.	Tor-pedoes.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
			Tons.		ft. in.	ft. in.	ft. in.				£	£			knots.	tons.	knots.
Sloop	**Melita**	*Comp.*	970	850	13 6	167 0	32 0	Malta	..	..	53,000		8 5-in. B.L.R., 1 l., 8 M.	..	11·00	150	2300
Despatch Vessel	**Mercury** 2 *s.*	Steel	3730	7290	22 0	300 0	46 0	Pembroke	Maudslay	1878	119,452	93,800	13 5-in. B.L.R., 4 Q.F., 2 l., 4 M.	4 tu.	18·60	780	4950
2nd Class Cruiser P.	**Mersey** (4) 2 *s.*	Steel	3550	6600	20 0	300 0	46 0	Chatham.	Humphrys.	1885	100,000 estim'td	54,000 estim'td	2 8-in. 14 ton B.L.R., 10 6-in. B.L.R., 3 Q.F., 10 M.	tu.	18·00	720	7400
Gun vessel	**Midge** 2 *s.*	*Comp.*	603	470	8 9	155 0	25 0	Glasgow.	Penn	1868	14,606	5,638	1 6½-in. M.L.R., 1 64 pdr. M.L.R. 2·20-pr. B.L.R., 2 M.	..	9·25	90	—
Sloop	**Miranda**	*Comp.*	1130	1020	15 9	170 0	36 0	Devonp'rt	Napier	1879	37,000 estim'td	11,700 estim'td	2 90-cwt. M.L.R, 4 64-pdr. do., 1 l., 4 M.	..	11·00	150	1480
Torpedo Cruiser.	**Mohawk** 2 *s.*	Steel	1630	4000	13 6	225 0	36 0	Glasgow.	Thomson	1886	*x*55,916	*y*31,667	6 6-in. B.L.R., 1 l., 8 Q.F., 2 M.	8 tu.	17·00	475	7000
Sloop	**Mutine**	*Comp.*	1130	1120	15 9	170 0	36 0	Devonp'rt	Maudslay.	1880	37,500 estim'td	11,770 estim'td	2 90-cwt. M.L.R., 4 64-pdr. do., 1 l., 6 M.	..	11·64	150	1480
Corvette	**Opal**	*Comp.*	2120	2190	18 7	220 0	40 0	Sund'land	Napier	1875	68,574	27,375	12 64-pdr., M.L.R., 2 l., 6 M.	..	13·13	270	2250
Sloop	**Osprey**	*Comp.*	1130	1010	15 11	170 0	36 0	Sheerness	Humphrys.	1876	39,664	11,674	2 90-cwt. M.L.R., 4 64-pdr. do., 1 l., 4 M.	..	11·64	150	1480
,,	**Pegasus**	*Comp.*	1130	970	15 9	170 0	36 0	Devonp'rt	Laird	1878	36,697	12,809	2 90-cwt., M.L.R., 4 64 pdr. do., 1 l., 4 M.	..	11·47	150	1750
,,	**Pelican**	*Comp.*	1130	1060	15 3	170 0	36 0	Devonp'rt	Humphrys.	1877	41,282	14,939	2 6-in. B.L.R., 6 5-in. B.L.R., 1 l., 4 M.	..	12·24	150	1480
	Penguin	*Comp.*	1130	1110	16 1	170 0	36 0	Glasgow.	Hawthorn.	1876	39,611	12,500	2 90-cwt. M.L.R., 2 5-in. B.L.R., 3 64-pdr. M.L.R., 1 l., 4 M.	..	10·00	150	1500
2nd Class Cruiser, pp.	**Phaeton** (3) 2 *s.*	Steel	3750	5600	20 6	300 0	46 0	Glasgow.	Napier	1883	86,763 estim'td	58,435 estim'td	10 6-in. B.L.R., 14 M. 2 l.	4 tu.	17·00	1000	11,000
Gun Vessel	**Philomel** 2 *s.*	Wood	805	800	10 6	170 0	29 0	Deptford.	Maudslay.	1867	20,220	8,233	1 90-cwt. M.L.R., 2 64 pdrs.	..	10·36	110	740
Torpedo Ram, P.	**Polyphemus** 2 *s.*	Steel	2640	5520	20 0	240 0	40 0	Chatham.	Humphrys.	1861	114,000	60,450	2 Q.F., 6 M.	5 tu.	17·80	300	3,400

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Torpedo Cruiser.	**Porpoise**	2 *s.*	Steel	1630	4000	13	6	225	0	36	0	Glasgow	Thomson	1886	5*x*5,916	*y*31,667	6 6-in. B.L.R., 1 l., 8 Q.F., M.	8 tu.	17·00	475	7000
Corvette, pp.	**Pylades**		*Comp.*	1420	1640	15	9	200	0	38	0	Sheerness	Laird	1884	45,500 estim'td	16,500 estim'td	14 5-in. B.L.R., 8 M., 1 l.	..	13·00	400	6400
Sloop	**Racer** (3)		*Comp.*	970	920	14	0	167	0	32	0	Devonp'rt	Hawthorn	1884	37,000	12,000	8 5-in. B.L.R., 1 l., 8 M.	..	11·00	150	2300
Torpedo Cruiser	**Racoon**	2 *s.*	Steel	1630	4500	13	6	225	0	36	0	Devonp'rt	..	..	*x*60,606	*y*31,000	6 6-in. B.L.R., 1 l., 8 Q.F., 2 M.	8 tu.	17·00	475	7000
Frigate	**Raleigh**		Iron wood and copper sheathed	5260	5640	24	7	298	0	49	0	Chatham	Humphrys	1873	147,248	46,138	8 90-cwt. M.L.R., 8 6-in., B.L.R. 8 5-in. do., 4 l., 12 M.	2 tu.	15·50	550	2100
Gun Vessel	**Ranger**		*Comp.*	835	760	13	7	157	0	29	6	Glasgow	Elder	1880	26,558	10,710	1 90-cwt. M.L.R., 2 64-pdr. do., 1 l., 2 M.	..	10·95	110	1050
„	**Rambler** (Surveying service).		*Comp.*	835	760	13	7	157	0	29	6	Glasgow	Elder	1880	26,625	10,413	4·20-pdr. B.L.R., 1 l., 1 M. [1 l.	..	10·66	40	1050
Corvette, pp.	**Rapid**		*Comp.*	1420	1400	15	9	200	0	38	0	Devonp'rt	Maudslay	1883	52,107	16,119	2 6-in. B.L.R., 10 5-in. do., 4 M.,	..	13·00	400	6000
Gun Vessel	**Ready**	2 *s.*	*Comp.*	610	890	9	10	155	0	25	0	Chatham	Penn	1872	17,231	6,613	1 7-in. M.L.R., 1·64-pd. do., 2 20-pdr. B.L.R., 2 M.	..	11·10	80	880
Sloop	**Reindeer**		*Comp.*	970	1030	14	0	167	0	32	0	Devonp'rt	Hawthorn	1883	34,834	52,787	6 5-in. do., 1 l., 8 M.	..	11·00	150	2300
Gun Vessel	**Rifleman**	2 *s.*	*Comp.*	610	710	10	1	155	0	25	0	Chatham	Penn	1872	17,970	6,589	2 90-cwt. M.L.R., 2 20-pdr. B.L.R., 2 M.	..	10·71	80	880
Corvette	**Rover**		Iron & wood and zinc sheathed	3460	4960	23	0	280	0	43	6	Blackwall	Ravenhill	1874	104,718	65,021	14 6-in. B.L.R., 3 l., 8 M.	2 tu.	14·53	410	1840
„ pp.	**Royalist**		*Comp.*	1410	1510	15	9	200	0	38	0	Devonp'rt	Maudslay	1883	52,134	16·039	2 6-in. B.L.R., 10 5-in. do. 4 M., 1 l.	..	13·00	400	6000
„	**Ruby**		*Comp.*	2120	1830	18	8	220	0	40	0	Hull	Earle	1876	66,113	27,003	12 64-pdr. M.L.R., 2 l.,6 M.	..	12·28	260	2080
„	**Sapphire**		Wood	1970	2360	18	1	220	0	37	0	Devonp'rt	Hawthorn	1874	51,986	26,311	12 64-pdr. M.L.R., 2 l., 6 M.	..	13·58	270	2080
Sloop	**Sappho**		*Comp.*	970	880	13	11	160	0	31	4	Blackwall	Humphrys	1873	29,749	91,242	2 90-cwt. M.L.R., 2 64-pdr. do., 1 l., 4 M.	..	10·59	100	1000
Corvette, pp.	**Satellite**		*Comp.*	1420	1400	15	9	200	0	38	0	Sheerness	Humphrys	1881	45,500 estim'td	..	8 6-in. B.L.R., 4 M., 1 l.	..	13·10	400	6000
Torpedo Cruiser.	**Scout** (6)	2 *s.*	Steel	1430	3200	14	6	220	0	34	0	Glasgow	Thomson	1885	*x*63,363	*y*23,000	4 5-in. B.L.R., 8 Q.F., 1 l., 2 M.	11 tu.,	17·00	450	6900
„ „	**Serpent**	2 *s.*	Steel	1630	4500	13	6	225	0	36	0	Devonp'rt	..	86/7	60,606	31,000 estim'td	6 6-in. B.L.R., 1 l., 8 Q.F., 12 M.	8 tu.	17·00	475	7000
2nd Class Cruiser, P.	**Severn** (4)	2 *s.*	Steel	3550	6600	20	0	3.0	0	46	0	Chatham	..	..	*x* 151,681	*y*60,940	2 8-in. 14-ton B.L.R., 10 6-in. B.L.R., 3 Q.F., 10 M.	tu.,	18·00	720	7408
Frigate	**Shah**		Iron wood and copper sheathed	6250	7480	26	5½	334	0	52	0	Portsm'th	Ravenhill	1873	177,912	57,333	2 12-ton M.L.R., 16 6½-ton do., 8 5-in. B.L.R., 4 l., 4 Q.F., 12 M.	3 tu.,	16·00	890	6840
Despatch Vessel.	**Surprise** (2)	2 *s.*	Steel	1400	3000	14	0	250	0	32	6	Jarrow	Palmer	1885	*x*49·084	*y*29,680	4 5-in. B.L 2, MF . Q R... 4,	..	17·00	400	6450

x Includes Gun Mountings, &c.

y Propelling Machinery.

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GREAT BRITAIN.—Unarmoured Cruising Ships, &c.—*continued.*

comp. composite hull; 2 *s.*, two screws; M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; M., machine gun; Q.F., quick-firing gun; l., light guns under 15 cwt., including boats' guns; tu, torpedo-tube or launching carriage; P., deck protected; pp., partial deck protected.

Class.	NAME.	Material of Hull.	Displacement.	Indicated Horse-Power.	Draught of Water.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Launch.	Cost.		Armament.		Speed.	Coal Endurance.	
											Hull.	Machinery.	Guns.	Tubes for Torpedoes.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
			Tons.		ft. in.	ft. in.	ft. in.				£	£			knots.	Tons.	knots.
Gun Vessel	**Swallow** . 2 *s.*	*Comp.*	1040	1500	11 6	195 0	28 0	Sheerness	Rennie	1886	44,797	15,000	8 5-in. B.L.R., 8 M.	..	13·50	280	5000
Gun Vessel	**Swift.** . 2 *s.*	*Comp.*	756	1010	10 11	165 0	29 0	Blackwall	Rennie	1879	24,290	10,380	2 90-cwt. M.L.R., 3 20-pdr. B.L.R., 2 M.	..	11·81	180	2400
Torpedo Cruiser.	**Tartar** . 2 *s.*	Steel	1630	4000	13 6	225 0	36 0	Glasgow	Thomson	1886	*x*55,916	*y*31,667	6 6-in. B.L.R., 1 l., 8 Q.F., 2 M.	8 tu.	17·00	475	7000
Corvette	**Tenedos** .	Wood	1760	2030	16 10	212 0	36 0	Devonp'rt	Elder	1870	39,226	20,121	12 64-pdr. M.L.R., 3 l., 6 M.	..	12·90	248	1990
„	**Thalia** .	Wood	2240	1600	18 3	200 0	40 4	Woolwich	Napier	1869	47,915	21,709	8 64-pdr. M.L.R., 2 l., 2 M.	..	11·14	230	2350
2nd Class Cruiser, P.	**Thames** (1) 2 *s.*	Steel	3550	6000	20 0	300 0	46 0	Pembroke	Penn	1886	151,952	53,500	2 8-in. 14-ton B.L.R., 10 6-in. B.L.R., 3 Q.F., 10 M.	tu.	18·00	720	7400
Corvette	**Thetis** .	Wood	1860	2270	17 6	220 0	36 0	Devonp'rt	Rennie	1871	43,963	21,147	14 64-pdr. M.L.R., 2 l., 6 M.	..	13·39	250	1990
„	**Tourmaline** .	*Comp.*	2120	1970	18 8	220 0	40 0	Middl'sbro	Hawthorn.	1875	69,998	25,771	4 6-in. B.L.R., 8 5-in. do., 2 l., 8 M.	..	12·62	280	2090
„	**Turquoise** .	*Comp.*	2120	1990	19 1	220 0	40 0	Hull	Earle	1876	68,089	27,458	12 64-pdr. M.L.R., 2 l., 6 M.	..	12·32	280	2080
Torpedo Vessel	**Vesuvius** . 2 *s.*	Iron	245	390	8 6	90 0	22 0	Pembroke	Maudslay	1874	10,522	7,465	Nil	4 tu.	9·71	25	—
Corvette	**Volage** .	Iron wood and copper sheathed	3080	4530	22 0	270 0	42 0	Blackwall	Ravenhill	1874	91,817	41,000	10 6-in. B.L.R., 2 64-pdr. M.L.R., 2 l., 10 M.	2 tu.	15·30	420	1850
Sloop	**Wanderer** .	*Comp.*	925	750	14 0	157 0	32 0	Middl'sbro	Hawthorn.	1883	25,850 estim'td	9,800 estim'td	2 6-in. B.L.R., 2 5-in. do., 1 l., 2 M.	..	10·50	135	1700
„	**Wild Swan** .	*Comp.*	1130	1090	15 10	170 0	36 0	Glasgow	Hawthorn.	1876	39,643	11,853	2 6-in. B.L.R., 6 5-in. do., 1 l., 4 M.	..	10·35	150	1120
Gun Vessel	**Woodlark** 2 *s.*	Wood	805	800	11 0	170 0	29 0	Chatham.	Watt	1871	..	..	1 90-cwt. M.L.R., 2 64-pdr. do., 1 l., 2 M.	..	10·34	100	690

x Includes Gun Mountings, &c.

y Propelling Machinery.

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Smaller Vessels, Gunboats.

Note.—Troop and store ships, yachts, armed tugs, harbour-service vessels, and surveying vessels are not included. Smaller Vessels, &c.

Paddle-wheel Vessels.—Alecto, Cockatrice, Helicon, Pioneer, Sphinx, Vigilant.

Torpedo Gunboats.—Grasshopper, 2 s. (1); Rattlesnake, 2 s.; Sandfly, 2 s.; Spider, 2 s. Hulls of steel; displacement, 450 tons; I.H.P. 2700. Of these vessels the Secretary of the Admiralty said, on 18th March, 1886: "These gunboats are of a new type, and are intended for the destruction of an enemy's torpedo boats. They are 200 ft. long, 23 ft. wide, and of 450 tons displacement, 2700 I.H.P., the speed being 19 knots. They will carry 100 tons of coal for 600 knots at full speed, or for 4000 knots at 10 knots an hour. They have no rig except two light poles for signals. The engines are twin-screw, and they cost about £35,000 for the hull and engines."

Composite Gunboats.—Bramble, Lizard, Rattler, Wasp. Displacement, 670 tons; I.H.P. 1000.

Albacore, Mistletoe, Watchful, 560 tons; I.H.P. 770.

Ariel, Banterer, Cockchafer, Coquette, Cygnet, Espoir, Express, Firebrand, Firefly, Firm, Forester, Forward, Goshawk, Grappler, Mallard, Merlin, Raven, Redwing, Starling, Stork, Swinger, Wrangler, Zephyr. From 430 to 465 tons; and from 310 to 520 I.H.P.

Older Type Gunboats.—Britomart, Cherub, Orwell, Speedy, 330 tons; from 218 to 227 I.H.P.; Skylark, 284 tons; I.H.P. 263.

Twin Screw Gunboats (Iron).—Dee, Don, Esk, Medina, Medway, Sabrina, Slaney, Spey, Tay, Tees, Trent, Tweed, 363 tons; 320 to 410 I.H.P.

Twin Screw Iron or Steel Gunboats (*Staunch Type*),—Bouncer, Insolent, Ant, Arrow, Badger, Blazer, Bloodhound, Bonetta, Bulldog, Bustard, Comet, Cuckoo, Fidget, Gadfly, Griper, Hyæna, Kite, Mastiff, Pickle, Pike, Pincher, Plucky, Scourge, Snake, Snap, Staunch, Tickler, Weasel, 180 to 254 tons; 130 to 270 I.H.P.

Torpedo Boats.—First class (over 100 ft. in length), sixty-one.

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Smaller Vessels, &c.

Second class (over 70 and under 100 ft.), nineteen. *Third class* (under 70 ft.), fifty. These numbers include two special boats of large size building.

The following vessels of various classes are noted in the official *Navy List* for January, 1886, as in the FOURTH CLASS RESERVE:—

Amethyst, Blanche, Boxer, Contest, Cracker, Danae, Fly, Foam, Foxhound, Growler, Hart, Hornet, Kestrel, Lynx, Modeste, Mosquito, Newcastle, Pert, Rocket, Seagull, Sheldrake, Teazer, Thistle.

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DETAILS OF CONSTRUCTION AND TRIALS OF RECENT SHIPS.*

(1.) The Grasshopper.

The Grasshopper and the other three vessels of the same class will be 200 ft. in length—the same length as the corvettes of the Caroline class—but their breadth is to be only 23 ft. The draught of water will be only 8 ft., thus securing them against the attack of Whitehead torpedoes set for the attack of ships. The armament of the Grasshopper class will be of a powerful character for vessels of their size, and will consist of four tubes, with the necessary apparatus for discharging the Whitehead torpedoes, one at the bow, one at the stern, and two amidships. They will also be equipped with one 4-inch breech-loading gun. The Grasshopper class will also carry six 3-pounder quick-firing guns. The vessels are to be fitted with engines of 2700 horse-power, acting on twin-screws, and it is estimated that they will possess a steaming power of 19 knots per hour in rough water, which is expected to give them an advantage in speed over any torpedo boat under these circumstances.

The Grasshopper.

(2.) The Surprise and Alacrity.

The Surprise is entirely built of steel, and is intended—like the sister-ship, the Alacrity — to serve as a despatch vessel. She measures 250 ft. in length, by 30 ft. 6 in., and has a displacement of 1400 tons. The load draught is 12 ft. and 14 ft. forward and aft respectively, with a freeboard of 6 ft. 9 in. Of the entire length the machinery compartments take up no less than 114 ft. As the Surprise is entirely unarmoured, various novel devices have been resorted to with the object of protecting her as far as possible against the attack of machine and light guns. An arched steel deck three-eighths of an inch thick runs throughout the whole length of the ship, enclosing the engine spaces, and this protection is supplemented at the ends by water-tight platforms, which afford a measure of safety against the consequence of collision and give rigidity to the structure.

The Surprise and Alacrity.

* These notes have been taken generally from articles in English journals. As they have all undergone editorial modification by way of correction, extension and abridgement, the sources are not acknowledged in detail.

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The Surprise and Alacrity.

Along the sides amidships, above and below the watertight deck, for a distance of 114 ft., are the coal-bunkers. These are 7 ft. in breadth, and are so arranged as to afford the defence of coal armour to the boiler rooms and other vital parts. Besides these means of safety, the hull is crossed by numerous transverse bulkheads disposed in connection with the arched deck so as to divide the ship into forty water-tight compartments. The larger hatches, again, are surrounded by coffer-dams, which, when penetrated by shot, could be easily rendered water-tight by being filled with hammocks and other light packing. Having to afford accommodation to ambassadors, admirals, and other temporary guests, embarking on official and ceremonial cruises, every attention has been devoted to secure comfort and beauty between decks.

The propelling machinery consists of two pairs of horizontal compound engines, having cylinders of 26 in. and 50 in. diameter respectively, with a stroke of 34 in. Steam is supplied at 100 lbs. pressure by four boilers, two of which have two furnaces and two have three furnaces each. The stokeholes are arranged to work either with natural or forced draught, the latter being produced by four fans each 4 ft. 6 in. in diameter. At the natural draught trial the collective power developed by the engines amounted to 2104 horses, which was considerably above the contract. The speed realised was 16·49 knots, while the coal consumption amounted to 2·6 lbs. per unit of power developed. At the trial the engines were worked for four hours under forced draught, when equally satisfactory results were obtained. After the first half-hour the engines gradually worked up so well that the mean results were taken from the beginning of the observations. These gave a mean of 96·6 lbs. pressure of steam in the boilers, 133 revolutions per minute, and a collective horse power of 3017·66. The efficacy of forced draught was thus clearly demonstrated, the more especially when it is stated that calculations made on board gave a fuel consumption of 2·78 per hour. The means of four runs on the mile gave a speed of 17·846 knots, the average of the log during the trial giving a speed of 18·31 knots. On the conclusion of the trial the steering of the ship was tested. The circle was 244 yards in diameter, and it took three minutes to perform it. This was done with manual gear. When commissioned the ship will have a complement of 86 officers and men. Her bunkers will stow 400 tons of coal.

The armament of these vessels consists of four 5-inch breech-loading rifled guns, four quick-firing 6-pounder guns, and two machine guns.

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(3.) The Leander, Arethusa, Phaeton, and Amphion.

The four new cruisers, Leander, Arethusa, Phaeton, and Amphion, though similar in type to the Iris and Mercury, differ from them in many important particulars. The armament consists of ten 6-inch breech-loading guns, two Gatling guns, ten Nordenfelt guns, four Gardner guns, and four tubes for launching Whitehead torpedoes. Four of the breech-loaders are fixed on revolving turntables which project beyond the sides of the ship. They are placed on either side of the upper deck at the fore end of the poop and after end of the forecastle. These bow guns can be trained from the cross fire of 4° forward to 45° abaft the beam, and the after guns from right aft fire to 45° before the beam. The remaining 6-inch breech-loading guns which these vessels carry are fitted at broadside ports on the upper deck in the ordinary way. The Nordenfelt guns are fitted in projecting parts of the topsides, and are so arranged as to give great training and great depression, firing into boats alongside. The Whitehead torpedoes are discharged from broadside ports on the lower deck, two forward and two aft. The Phaeton class differs from the Iris in having a protecting deck. The vessels are built of steel. The distinctive feature of the class is that they are unarmoured cruisers, having the magazines and machinery protected by a steel deck 1½ in. thick, and sloped at the sides in order to deflect any shot striking the vessel near the water line. When the coal bunkers are filled, these too will afford some protection, as they are ranged along the sides and across the ends of what has been called the vital part of the ship; and with regard to their steaming capabilities, it may be noted that these cruisers with an authorized complement of coal of 725 tons have room in the bunkers for 1000 tons. They also carry three masts, but are not expected to have much sailing power. Provision has of course been made by watertight bulkheads and numerous compartments for keeping the ship afloat if struck by shot or otherwise injured in the hull. The Leander struck upon the Hornet Rock shortly after she was commissioned. The sea entered through numerous rivet holes where rivets had been sheared, but the compartments kept the ship afloat in a working condition.

The Leander, Arethusa, Phaeton, and Amphion.

The Phaeton has been tried in the Solent. At the previous six hours' full power trial of the Phaeton there was a difficulty experienced in maintaining steam from want of draught in the stokeholes. (Only the Leander of this class has been fitted with fans for forced draught.) The funnels were afterwards raised from 60 ft. to 68 ft. (the same height as those of the first-class cruisers), while the space

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The Leander, Arethusa, Phaeton, and Amphion.

between the firebars was increased. The effect of these changes at the trial was very marked, the engines being provided with an abundance of steam without there being any necessity for resorting to the blast. The trial was intended to have been for six hours, but during the eleventh half-hour, the expansion gear of the starboard engine heated and snapped, and the run was brought to a premature close. As, however, the machinery worked without a hitch of any kind, and was developing power largely in excess of the Admiralty contract, it was agreed by the officers superintending the trial to accept the means of the five hours as a sufficient test of performance. These afforded the following data: Steam in boilers, 85·35 lbs.; vacuum, 25·3 in. starboard and 24·8 in. port; revolutions, 100; mean pressures, starboard, 43·7 and 11 lb., and 43 and 11·7 lb. port; collective horse power, 5574·88, or nearly 600 horses beyond the contract. The mean speed registered by runs on the measured mile was 18·684 knots, which was remarkable, notwithstanding her light draught. The coal consumption did not exceed 2·39 lbs. per unit of power per hour.

(4.) The Mersey.

The Mersey, Severn, Thames, and Forth.

The hull of the Mersey is formed of steel. The horizontal deck plating is 2 inches in thickness, and that on the slopes 3 inches, the latter being further protected by ample coal "spaces," or bunkers, which serve the double purposes of fuel-stores and extra armour plating. Within this "protected" hull are placed the engines, boilers, magazines, and steering apparatus. On the upper deck is a 9-in. armour steel-faced conning tower; the bulwarks are higher than usual and of ½-inch plate; the "bays" between the gun stations are especially adapted to afford shelter to the gunners; and by the stowage of hammocks, sails, and spare gear in the "bays," additional protection against shell is secured. The after part of this deck is apportioned to the officers' cabins, and right aft is a 6-inch breech-loading sternchaser capable of being employed on each broadside and of sweeping the keel-line. On the main deck are the captain's saloon, officers' quarters, torpedo ports, pumps, &c.

The following is a statement of the armament:—Two 8-in. 14 ton and ten 6-in. breech-loading guns; two 9-pounder boat and field gun; one 7-pounder ditto, three quick-firing guns; eight 1-in. Nordenfelt and two ·45-in. Gardner guns; in addition to which Whitehead torpedoes will be carried for discharging above and below water on each broadside. The semi-circular projections on the vessel's side—two on each side—are steel "loading stations" for working the machine guns on the upper deck. The principal

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dimensions of the vessel according to the official measurements are :—Length between the perpendiculars, 300 ft., breadth, extreme, 46 ft.; draught of water: forward, 16 ft.; aft, 19 ft. 6 in.; mean, 17 ft. 9 in. The load displacement is estimated at 3550 tons. The engines are in two sets, one on each side of the ship, and are of the horizontal compound order of 6600 indicated horse power. There are two propellers, computed to be able to maintain a speed of 18¼ knots per hour. The authorized complement of coals is 500 tons, but she can carry 720 tons, which would enable her to steam far above 7000 knots at 10 knots per hour. Accommodation has been provided for 300 officers and men. The Mersey, Severn, and

(5.) The Racer.

The Racer is armed with four 5-inch central pivoting guns on Vavasseur mountings, and four 5-in guns on Vavasseur broadside mountings. There are also four 2-barrelled Nordenfelt guns, two under the poop and two under the forecastle. The machine guns include in addition two 5-barrelled Gardner guns and two 2-barrelled guns of the same description fitted on the broadside and in the tops. One of the boats also carries a 7-pounder gun. The engines of the ship are compound surface condensing horizontal return connecting-rod engines. The engines are fitted with Marshall's valve gear. The propellers are fitted with Bevis's feathering gear. The Racer.

(6.) The Scout.

The Scout is practically an enlarged torpedo boat, but she is intended to keep the sea in all weathers, and her machinery is protected by being under water, and covered by a steel deck. She has a torpedo armament of eleven separate torpedo ejectors. Her speed of over seventeen knots, her great steering power, and moderate size will enable her to turn very rapidly. The Scout.

The vessel is 220 ft. long between perpendiculars, 34¼ ft. extreme breadth, and 19 ft. moulded depth. The displacement is 1430 tons at the ordinary load draught. The vessel has two complete decks, an upper and a lower. On the former are worked all the torpedo tubes excepting one which is fitted through the stem under the water line. The ends of this deck are covered by a poop and forecastle, each about 55 ft. long, and forming perfectly water-tight compartments. Three of the torpedo tubes are worked under the forecastle, one firing right forward, the other two firing on the broadside. Four tubes are worked in the open part of the upper deck, but as the

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The Scout. bulwarks are carried solid to the height of the poop and forecastle, they are fairly well protected. Three tubes are carried under the poop, one firing right aft, the other two firing on the broadside. In addition to these there are eight Nordenfelt machine quick-firing guns fitted in the topsides. The whole of this armament is protected by 1-in. steel plating. At each of the forward corners of the poop and the after corners of the forecastle is fitted a 5-in. breech-loading central-pivoted gun, mounted on a sponson projecting beyond the ship's side. These guns have practically an uninterrupted range from right forward to right aft on their own side of the ship. The under-water torpedo tube through the stem is made suitable for a 14-in. Whitehead. The bow is bossed out about 8 ft. below the water line, to allow the torpedo to pass out through it, and a shifting cap is fitted over the aperture. This cap can be turned clear of the tube by means of gearing inside the ship. In addition to this a large sluice valve is fitted inside the stem on the forward end of the tube, and a sluice door is fitted on the after end, where the torpedo is entered. On the forecastle is a conning tower, formed of 3-in. plates, in which are all the telegraphs and voice pipes by which the ship can be controlled. It is oval in shape, with an opening in the after end, covered by a screen plate, about 2 ft. abaft of it. The lower deck right forward is fitted up for the stowage of the electrical stores. In the next two compartments is part of the crew's accommodation, the remainder being under the forecastle on the upper deck. For the length of the machinery space—which is 100 ft. —the lower deck at the side is occupied by coal bunkers, about 8 ft. thick. The stability of this ship in an action may be increased very much as compared with an ordinary unarmoured ship by the protecting and water-excluding qualities of the coal and stores over the machinery space, and arrangements are therefore made so that in war time the whole of this space may be filled with coal. Below the lower deck, commencing forward, are the torpedo store-rooms and torpedo magazines, the provision rooms, the powder magazines, the condenser room, and chain cable lockers—all before the machinery. Abaft are the steering engine room—the engine being by Forrester—the small-arms magazine, the bread room, spirit rooms, and other small store rooms; and right aft the most important compartment in the ship, viz., that where the steering apparatus is placed.

The hull is built of steel throughout on the ordinary floor system, but instead of having frames and reverse frames formed of separate angles, the framing is formed of a Z bar 6 in. by 3½ in. by 3 in. The bulkheads necessary for the minute sub-division of the hull form

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integral portions of the structure, and have in a large degree contributed to the great strength of the vessel. The floor-plates are $\frac{5}{16}$ in. in thickness; the bulkheads vary from $\frac{1}{4}$ in. to $\frac{1}{8}$ in. The outside bottom plating is a little less than $\frac{5}{16}$ in. The upper deck stringer is $\frac{3}{8}$ in.; the watertight deck over the machinery is $\frac{3}{8}$ in. The frames are spaced 23 in. apart. The upper deck is of $3\frac{1}{2}$ in. crown deals, while the lower deck is of $2\frac{1}{2}$ in. The watertight or protective deck has no planking on it, except in the passages, where $1\frac{1}{4}$ in. teak is laid. The stem, sternpost, shaft brackets, steering tiller, and a large number of other things which are usually made of wrought iron have been made of mild cast steel. The Scout.

The preliminary trials of this vessel took place on the Clyde, on the 20th August, 1885. The engines are horizontal compound, working at 120 lbs. pressure; there are two independent sets, one for each screw, each having cylinders of 26 in. and 46 in diameter with 30 in. stroke. The cylinder liners are of fluid compressed steel. The slide valves are all of the piston type. The condensers are of brass and are circular in form, having 5200 square feet cooling surface. There are four boilers, each 9 ft. in diameter and 18 ft. long, with three corrugated furnaces, having in all 200 square feet of grate. The safety valves are loaded to 120 lbs. The stokeholes are closed air-tight and are put under air pressure by four fans, two in each stokehole. The whole of the machinery is under the steel deck, the boilers being in two separate compartments. On the trial, with an air pressure in the stokehole equal to $1\frac{1}{2}$ in. of water, the average indicated horse-power was 3370, or $16\frac{1}{4}$ horse-power per square foot of grate. The engines were running at 152 revolutions, and the ship attained a mean speed of 17·577 knots per hour on the measured mile; without the forced draught the revolutions fall to 139, and the indicated power to 2177 horses.

Under precisely similar conditions the device of closing the stokeholes and forcing air by fans raises the speed of the ship from $16\frac{1}{4}$ knots to $17\frac{1}{2}$ knots. This modern improvement, which is of inestimable value in reducing the size and cost of fast ships of war, was first devised by Mr. Thornycroft for "locomotive" marine boilers, and was then adapted by the French engineers to ordinary marine boilers. Our engineers have followed. They have at the same time greatly improved and extended the system.

The fast vessels designed by Sir Wm. Armstrong & Co., and engined by Messrs. Hawthorn, have owed their high speed to this device; to which they were guided by the trials of the Satellite and Conqueror, as arranged by Mr. James Wright, Engineer-in-Chief to the Royal Navy.

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(7.) The Archer.

The Archer.

This vessel represents a class consisting of Archer, Brisk, Cossack, Mohawk, Porpoise, and Tartar and, with the exception that the type of engine is different, and the anticipated power greater, she also represents the two more recent vessels, Racoon and Serpent. The first-named six vessels are building on the Clyde by Messrs. J. & G. Thomson, and the two last-named are building at Devonport. In general character the vessels of the Archer class are like the Scout and Fearless. But in the later class the armament of guns has been greatly increased and strengthened, and the torpedo armament has been reduced, as may be seen by the information given in the Tables.

(8.) Curlew and Landrail.

The Curlew and Landrail.

These vessels represent the views of those who think the smaller classes of gun-vessels in the British Navy pay too much in speed under steam for the advantage which their sail power gives them in training officers and men. Taking the Falcon as a gun vessel of the older type representing a large number of vessels designed for training on foreign service, and in which the existing *personnel* of the Navy has been mainly trained, we see the following differences:—

		Falcon.		Curlew.
Displacement	Tons	780	..	790
Length	Feet	157	..	195
Breadth	„	29½	..	28
Draught of Water	„	13	..	10½
Power of Engines	Horses	720	..	1200
Coal carried	Tons	120	..	250
Full speed under steam	Knots	10·7	..	14·0
Officers and Men		100	..	90
Cost		£37,000	..	£50,000

The Falcon sails well. The Curlew has no sail power.

The Falcon is built with iron frames, double wood bottom, copper fastened and copper sheathed. The Curlew has a single thin steel bottom, unsheathed.

So far therefore as the usefulness of these vessels in training is concerned, we have to give for training 100 men £55,500 per ship, instead of £37,000, or we get, in other words, two ships instead of three for the same money. We burn coal always; there is no training in sails; the new type will be less safe in unsurveyed waters, and in coasting and river work, and must be frequently docked to clean their bottoms.

As fighting vessels they have a marked superiority. For training and police duties on the seas, the older type has many advantages.

Note.—Recent steam trials of Curlew show that these vessels will have a speed of 15 knots at the measured knot.

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FOREIGN
ARMOURED AND UNARMOURED SHIPS.

THE principal dimensions and other details of the ships in the following lists have been in many cases extracted from the Austrian *Marine-Almanach.* No previously published list, however, contained all the necessary information, and it has been collected from a very large mass of materials. With few exceptions all details concerning the ships of any nation have been printed either in the naval periodicals or in the English newspapers, and in those of foreign countries. Where the latter sources of information failed, the deficiency has been made up from the *Navy Estimates* submitted to the several national Parliaments, and from other public official documents. It would have been impossible in every case to note the source from which each detail was derived without overburdening the pages with references and adding enormously to the size of the book.

The alphabetical arrangement of the ships in each of the two great divisions, armoured and unarmoured, has been followed so as to facilitate reference. Armoured ships with wooden hulls have been distinguished by the use of a special type. There being now no uniform system of classifying the ships of all nations, an attempt has been made to assimilate as far as possible the classification of foreign fleets to that adopted in the British *Navy List.* Occasionally this has been only approximately practicable, and it will be observed that the distinction between the smaller gun-*vessels* and the sea-going gun-*boats* is not always apparent, and the former term applied by some nations to craft to which we apply the latter has, for special reasons, been preserved.

The designation of foreign guns by *centimetres* of calibre will permit easy reference to the Tables of Ordnance of the several powers. In general, it may be stated that, as every nation is engaged in either replacing its naval ordnance with new and improved pieces, or in re-

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arranging the armament of individual ships, it has been only possible to republish the latest accessible information on the subject. The machine gun and torpedo armaments of any fleet vary continually.

In the Tables figures of the decimal system have been converted into the English equivalents. In the notes the authority from which the information is quoted frequently gives the smaller details, especially of armour plating, in round numbers, which will explain any slight discrepancy between the figures in the notes and those in the Tables.

ABBREVIATIONS.

A list of Abbreviations of the several classes of ships and vessels is placed at the head of each Table. The following refer to armaments throughout:—

B.L.R.	Breech-loading rifled gun.
M.L.R.	Muzzle „ „ „
l.	Light gun.
M.	Machine gun.
Q.F.	Quick-firing gun.
tu.	Torpedo tube or launching apparatus for Whitehead Torpedoes.

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ARGENTINE REPUBLIC.—Armoured Ships.

c.b., central-battery ship; *c.s.t.*, coast-service turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Endurance.	
					Belt.	Battery.					Guns.	Torpedoes.				Coals that can be carried in Bunkers.	At ten knots.
		Tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.b.	**Almirante Brown** (steel)	4200	240 0	50 0	9 (comp.)	8 (comp.)	11 & 8	20 6	2	4500	8 8-in. 11½-ton B.L.R., 6 4½-in. do. (Armstrong) 4 M.	..	1880	..	13·75	650	4800
c.s.t	**Andes**	1535	186 0	44 0	6	8 (turret)	11⅞	9 6	2	750	2 12½-ton Armstrong M.L.R., in turret, 2 lt. and 4 M.	..	1875	..	9·05	120	2880
„	**Plata**	1535	186 0	44 0	6	8 „	11⅞	9 6	2	750	2 12½-ton Armstrong R.L.R., in turret, 2 l.	..	1874	..	9·05	120	2880

ARGENTINE REPUBLIC.—Unarmoured Ships.

cr., cruiser; *g.v.*, gun-vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch	Cost.	Speed.	Coal Endurance.	
									Guns.	Torpedoes.				Coals that can be carried in Bunkers.	At ten knots.
			ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
cr.	**Patagonia** . .	1530	215 0	32 10	Steel & wood	12 9	2	2400	1 10-in. B.L.R., 3 6-in. do., 6 l., 10 M. .	..	..	..	14·00	350	—
g.v.	**Parana** . . .	550	142 8	25 0	Iron	11 9	1	475	2 6½-ton M.L.R., 2 lt.	..	1874	..	11·0	—	—
„	**Uruguay** . .	550	142 8	25 0	Iron	11 9	1	475	2 6½-ton M.L.R., 2 lt.. . . .	..	1874	..	11·0	—	—

4 *Gunboats* (*Rendel type*), 416 tons, 420 I.H.P.; 4 1*st class Torpedo boats* (*for Whiteheads*); 4 *Spar Torpedo boats;* 1 *paddl* *Torpedo vessel,* Maipu; 7-*screw steam vessels;* 6 *paddle-wheel vessel,* besides steam transports.

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AUSTRIA.—Armoured Ships.

b., barbette ship; *br.*, broadside ship; *c.b.*, central-battery ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Endurance.	
					Belt.	Battery.					Guns.	Torpedoes.				Coals that can be carried in Bunkers.	At 10 knots.
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	
c.b.	**Archduke Albert** (iron)	5940	285 2	56 3	9	7	9½	22 0	1	4060	8 24-c.m. B.L.R. 15½-ton Krupp, 6 9 c.m. Uchatius, 2 l., 6 M.	..	1872	357,600	13·00	453	1472
b.	**Archduke Ferdinand Max** (1) (steel)	5100	287 5	55 10	9	8	..	21 8	2	6500	2 30½-c.m. (35 calibs.) Krupp, 6 15 c.m. (35 cals.) Krupp, 2 l., 6 M.	..	Bldg.	..	..	400	—
b.	**Crown Prince Rudolph** (2) (steel)	6900	295 0	62 4½	12	11		23 3	2	6500	3 30½-c.m. (35 cals.) Krupp, 6 9 c.m. Uchatius, 2 l., 6 M.	..	Bldg.	..	14·00	600	—
c.b.	**Custoza** . (iron)	7060	302 3	58 0	9	7	8¼	24 6	1	4820	8 26-c.m. 22-ton Krupp, 6 9 c.m. Uchatius, 2 l., 6 M.	..	1872	414,400	14·00	584	1624
c.b.	**Don Juan de Austria** (iron)	3550	240 3	50 0	8	6½	9¾	20 0	1	2920	8 21-c.m. 10-ton Krupp, 4 9 c.m. Uchatius, 2 l., 6 M.	..	1875	..	13·00	380	2000
br.	*Habsburg* . (wood)	5140	262 0	52 0	5	5	27⅞	23 9	1	3500	14 7-in. M.L.R. Armstrong, 4 9 c.m. Uchatius, 2 l., 5 M.	..	1865	280,672	12·00	330	—
c.b.	*Kaiser* . (wood)	5810	254 0	58 3	6¼	5½	31	24 3	1	3200	10 9-in. Armstrong M.L.R., 6 9 c.m. Uchatius, 2 l., 6 M.	..	1871	337,200	13·00	450	1519
c.b.	**Kaiser Max** (iron)	3550	240 3	50 0	8	6½	9¾	20 0	1	2890	8 21-c.m. 10 ton Krupp, 4 9 c.m. Uchatius, 2 l., 6 M.	..	1875	211,600	13·00	380	2000
c.b.	*Lissa* . (wood)	6080	288 3	56 9	6¼	5½	29⅞	26 0	1	4200	12 24-c.m. 15½-ton Krupp, 4 9 c.m. Uchatius, 2 l., 6 M.	..	1869	412,800	13·00	490	1420
c.b.	**Prince Eugene** (iron)	3550	240 6	50 0	8	6½	9¾	20 0	1	2960	8 21-c.m. 10-ton Krupp, 4 9 c.m. Uchatius, 2 l., 6 M.	..	1877	..	13·00	380	2000
c.b.	**Tegetthoff** (iron & steel)	7390	286 11	71 1	14½	14½	9¾	24 10	1	6500	6 28-c.m. 27-ton Krupp, 6 9 c.m. Uchatius, 2 l., 6 M.	..	1878	?247,378	14·00	670	3300
b.	**Archduke Ferdinand Max** (wood)	5060	272 0	52 6	5	5	..	23 6	1	3500	14 21-c.m. Krupp, B.L., 4 l.	..	1865	..	12·50	330	—
River Monitor	**Leitha** (iron & steel)	310	166 0	27 6	1¾	2½ (turret)	7½	3 7	2	320	2 15-c.m. Wahrendorf, 1 M.	..	1871	20,000	8·00	20	—
„	**Maros** (iron & steel)	310	166 0	27 6	1¾	2½ (turret)	7½	3 7	2	320	2 15-c.m. Wahrendorf, 1 M.	..	1871	20,000	8·00	20	—

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AUSTRIA.—Unarmoured Ships.

corv., corvette; *fr. cr.*, frigate-built cruiser; *g.v.*, gun-vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at knots.
									Guns.	Torpedoes.					
		Tons.	ft. in.	ft. in.		ft. in						£	knots.	tons.	miles.
g. v.	**Albatross**	570	150 11	26 3	wood	11 2	1	580	2 15-c.m. Wahrendorf, 1 l.	..	1873	..	10·00	60	—
fr. cr.	**Archduke Frederic**	1570	173 10	39 5	wood	16 9	1	780	14 15-c.m. Wahrendorf, 1 l.	..	1874	..	9·00	200	—
corv.	**Aurora**	1340	190 6	32 10	composite	16 1	1	1170	4 15-c.m. Wahrendorf, 1 l.	..	1873	..	11·00	160	—
fr. cr.	**Donau**	2510	233 4	42 8	wood	19 8	1	1430	11 15-c.m. Krupp, 1 l.	..	1874	..	12·00	320	—
Torpedo vessel.	**Ersatz Seehund**	1550	224 0	37 0	steel	14 0	2	6200	2 12-c.m. Krupps, 10 Q.F.	4 tu.	1886	..	18·50	250	—
corv.	**Fasana**	1970	223 3	39 5	wood	16 9	1	1750	4 15-c.m. Krupp, 1 l.	..	1870	..	12·00	315	—
,,	**Frundsberg**	1340	190 6	32 10	composite	16 1	1	1260	4 15-c.m. Wahrenrdorf, 1 l.	..	1873	..	11·00	160	—
,,	**Helgoland**	1820	226 6	36 2	wood	16 9	1	1860	5 15-c.m. Krupp, 1 l.	..	1867	..	12·00	250	—
g. v.	**Hum**	900	173 10	29 6	wood	12 6	1	920	4 15-c.m. Wahrendorf, 1 l.	..	1861	..	13·00	150	—
,,	**Kerka**	540	146 8	26 3	wood	11 2	1	300	2 15-c.m. Wahrendorf, 1 l.	..	1860	..	9·00	50	—
fr. cr.	**Laudon**	3430	253 0	46 0	composite	20 8	1	2850	15 15-c.m. Krupp, 2 l.	..	1873	..	13·00	450	—
Torpedo vessel	**Leopard** (3) 2 *s*	1550	224 0	34 0	steel	14 0	2	6200	2 12-c.m. (35 cal.) Krupps, 10 Q.F.	4 tu.	1886	200,000	18·50	250	—
,,	**Lussin**	913	200 4	26 3	steel	12 2	2	2600	2 15-c.m. (35 calibre) Krupp, 1 l., 2 M.	..	1883	..	14·00	200	—
g. v.	**Narenta**	540	147 8	26 3	wood	11 2	1	310	2 15-c.m. Wahrendorf, 1 l.	..	1860	..	9·00	50	—
,,	**Nautilus**	570	150 11	26 3	wood	11 2	1	410	2 15-c.m. Wahrendorf, 1 l.	..	1873	..	9·00	60	—
Torpedo vessel.	**Panther** (3) 2 *s*	1550	224 0	34 0	steel	14 0	2	6200	2 12-c.m. (35 cal.) Krupps, 10 Q.F.	4 tu.	1885	..	18·50	250	—
fr. cr.	**Radetzky**	3430	253 0	46 0	composite	20 8	1	2800	15 15-c.m. Krupps, 2 l.	..	1872	..	14·00	450	—
,,	**Saida**	2440	233 4	42 8	wood	19 1	1	2010	11 15-c.m. Uchatius, 1 l.	..	1878	..	12·00	320	—
g. v.	**Sansego**	350	111 7	23 0	wood	9 0	1	290	2 15-c.m. Wahrendorf	..	1861	..	9·00	45	—
Torpedo vesssel.	**Sebenico**	880	187 0	26 3	steel	12 2	2	2600	4 9-c.m. Uchatius, 1 l., 2 M.	..	1882	..	14·00	200	-
,,	**Spalato**	840	179 6	26 3	steel	12 2	2	2600	4 9-c.m. Uchatius, 1 l., 2 M.	..	1879	..	14·00	150	—
,,	**Zara**	840	179 6	26 3	steel	12 2	2	2600	4 9-c.m Uchatius, 1 l., 2 M.	..	1879	..	14·00	150	—
corv.	**Zrinyi**	1340	19 6	32 10	composite	16 1	1	1170	4 15-c.m. Wahrendorf, 1 l.	..	1871	..	11·00	160	—

Paddle-wheel vessels, Andreas-Hofer, Greif, Taurus, Trieste; and two gunboats of 320 tons displacement and 360 indicated horse-power; also Yachts, Harbour Service and Training Ships.

First-class Torpedo boats, Adler, Falke, and two others building (4); *second-class do.*, eighteen, and *eight* building; *third-class do.*, eight (5).

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NOTES ON THE AUSTRIAN NAVY.

The Archduke Ferdinand Max.

(1) The Archduke Ferdinand Max is being built to replace the wooden-hulled armour-clad of the same name. She has a complete armour belt and one oval barbette turret for two heavy guns. Abaft the barbette-turret on the main deck are six 15-c.m. guns on the broadside, protected from machine-gun fire. She has two masts with armed tops.

The Crown Prince Rudolf.

(2) The Crown Prince Rudolf has an armoured central citadel and two barbette-turrets of oval shape, extending beyond the sides. One is abaft the one-third division of the ship's length, the other amidships. The guns' crews are protected by shields. The light broadside guns are placed in an unarmoured battery between the barbette-turrets. The ship has one mast with an armed top.

An unarmoured cruiser, of which the details have not yet been published, is about to be built for the Austrian Navy.

The Panther and Leopard.

(3) The Panther is 224 feet long (4 feet longer than the Scout), 34 feet broad, and has a mean draught of about 14 feet when fully laden. Her displacement is about 1550 tons. The hull is entirely of steel. The boilers are placed in two separate compartments and covered by a steel deck, forming a bottom to the upper coal bunkers. The space between this deck and the upper deck is cut up into small compartments by longitudinal and transverse bulkheads, all openings being protected by coffer-dams. The engines are of the vertical inverted cylinder type, instead of being horizontal. The disadvantage is the greater exposure of the cylinders, &c., in the Panther than in the horizontal engines of the Scout and Archer classes in the British Navy. Coal bunkers are constructed abreast the engines; over the cylinders steel protecting shields or covers are fitted. In action the engine room can be completely shut down, proper means of lighting and ventilating being provided.

The Panther is to carry two long-range Krupp guns, mounted on sponsons, and a large number of Hotchkiss rapid-firing shell guns. She is also to be armed with Whitehead torpedoes ejected from four tubes above water. The ship is fitted with a high forecastle and poop. There are two light masts fitted with fore and aft sails. Steam-steering gear is fitted, the gear and rudder being under water. A steel conning tower, placed on the forecastle, is the station for the captain in action.

The mean speed of six consecutive runs was found to be rather

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above 17·6 knots, with natural draught only in the stokeholds. Next the vessel was taken to sea for twenty-four hours' continuous steaming, and in the course of this trial she ran 70·6 knots in four hours, with natural draught only in the stokeholds, thus repeating and confirming her measured mile performance. At the end of the 24 hours, and without entering harbour, the speed trial under forced draught was made on the measured mile, with the result that the mean of six runs gave a speed of 18·4 knots per hour. The indicated power developed with forced draught was about 6200 horses.

The Adler.

(4) On the 14th January, 1886, the official trial took place of the torpedo boat Adler, which Messrs. Yarrow and Co. have completed for the Austrian Government, and the speed obtained was 22·4 knots loaded with 16·9 tons, representing the fully equipped condition. The Adler is the fastest torpedo boat at present afloat, and will shortly leave this country for Pola. Her dimensions are 135 feet in length by 14 feet beam. The officers' accommodation in this case is forward of the machinery, and the crew are placed aft, which is the usual practice in the Austrian service. There will be two torpedo guns fitted forward for direct ahead fire. The coal capacity is equivalent to a run, at a speed of 11 knots, of from 2000 to 2500 miles.

(5) The number of torpedo boats belonging to the Austrian Navy on the 1st January, 1886, including those building, was stated by Rear-Admiral the Hon. E. R. Fremantle, at the Royal United Service Institution, to be—*First class* (over 100 feet in length), thirty. *Second class* (over 70 feet and under 100 feet), seven. *Third class* (under 70 feet), one.

BELGIUM.

Though Belgium has no Navy properly so called, there are about a dozen steam vessels, principally employed as packets, which are under the orders of the Government, and of which several would be found useful under certain conditions of naval warfare. Seven of these steamers are of 578 tons.

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BRAZIL.—Armoured Ships.

c.b., central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship.

Class.	NAME.		Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
						Belt.	Battery on Turret.					Guns.	Torpedoes.					
			tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
River Monitor.	*Alagoas* . .	(wood)	340	120 0	28 0	4	4½ on turret	14½	4 10	2	180	1 70-pdr. Whitworth M.L.R.	..	1867	..	7·50		—
t.	**Aquidaban** (2) .	(steel)	4950	280 0	52 0	11 comp.	11½ comp., 10 comp. on turret	10	18 0	2	6200	4 9-in. 20-ton B.L.R. (Armstrong) 4 70-pdr. do., 15 M.	5-tu.	1885	345,000*	16·00	600	—
c.s., *t.*	**Bahia** . .	(iron)	1000	178 0	35 0	3	4½ on turret	10⅛	8 6	1	1640	2 7-in. M.L.R. (Whitworth) .	..	1865	..	10·50	—	—
c.s., *c.b.*	**Brazil** (2) . .	(iron)	1518	179 8	35 0	4½	4½ on turret	8	12 5	1	1500	4 7-in. M.L.R. (Whitworth), 4 68-pdr., 4 l., s b.	..	1864	60,000	11·30	—	—
t.	**Javary** . .	(iron)	3700	240 0	58 0	12	13 on turret	9¾	11 5	2	2500	4 10-in. Whitworth M.L.R., 5 M.	..	1875	..	11·20	200	680
c. s., *t.*	**Lima-Barros** (2)	(iron)	1350	180 0	36 0	4½	4½ on turret	8½	13 5	2	2100	4 7-in. Whitworth M.L.R. .	..	1866	..	12·00	200	—
cs., *c.b.*	**Mariz-e-Barros**	(iron)	1444	198 10	36 0	4½	4½ on turret	8⅜	10 10	2	600	4 7-in. Whitworth M.L.R. .	..	1866	..	9·00	—	—
River Monitor	*Para* . . .	(wood)	340	120 0	28 0	4	4½ on turret	14½	4 10	2	180	1 70-pdr. Whitworth M.L.R. .	—	1867	—	7·00	—	—
t.	**Riachuelo** (1) .	(steel)	5700	305 0	52 0	11 comp.	11 comp., 10 comp. on turret	10	19 6	2	7300	4 9-in. 20-ton B.L.R. (Whitworth, altered by Armstrong), 6 5½-inch do., 15 M.	5 tu.	1883	365,000*	16·71	800	4,500 (at 15 knots)
River Monitor	*Rio Grande* . .	(wood)	340	120 0	28 0	4	4½ on turret	14½	4 10	2	180	1 70-pdr. Whitworth M.L.R. .	..	1864	..	7·50	—	—
c.b.	*Sete de Setembro*	(wood)	2145	219 10	46 6	4½	4½	..	12 6	2	2000	4 9-in. Whitworth M.L.R., 5 M.	..	1874	..	12·00	—	—
t.	**Solimoes** . .	(iron)	3700	240 0	58 0	12	13 on turret	9¾	11 5	2	2200	4 10-in. 25-ton Whitworth M.L.R., 5 M.	..	1875	—	11·20	200	680

* Exclusive of guns and ammunition.

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BRAZIL.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *g.v.*, gun-vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
g.v.	**Araguary** . . .	540	144 5	24 3	wood	7 10	1	240	1 70-pdr. Whitworth, 1 68-pdr., s.b. .	..	1858	..	8·0	—	—
cr.	**Almirante Barroso** .	1960	213 5	36 2	composite	17 5	1	2200	7 5½-in. Whitworth B.L.R., 4 M. . .	—	—	—	—	—	—
corv.	**Guanabàra** . . .	1900	200 0	41 2	wood	16 4	1	3000	9 70-pdr. Whitworth, 6 M. . . .	..	1877	..	14·00	—	—
cr.	**Imperial Marinheiro** .	726	167 0	26 3	wood	11 0	1	750	6 12-c.m. B.L.R., 1 9-c.m. do., 4 M. .	..	1883	..	9·00	—	—
corv.	**Nictheroy** . . .	1800	192 0	41 0	wood	16 0	1	1200	14 70-pdr. Whitworth, 6 M. . . .	..	1862	..	8·00	—	—
„	**Magé**	791	181 0	26 11	wood	11 10	1	650	2 70-pdr. Whitworth 6 32-pdr. . .	—	—	—	—	—	—
„	**Parnahyba** . . .	838	170 6	26 3	composite	11 2	1	900	1 70-pdr. Whitworth 6 lt. . . .	..	1878	..	10·00	—	—
cr.	**Primeiro de Março** .	726	167 3	26 3	composite	10 6	1	750	7 4½-in. Whitworth, B.L.R., 4 M. . .	..	1881	..	9·00	—	—
g.v.	**Rio Sado** . . .	550	151 0	29 6	composite	11 6	1	500	1 18-c.m. Armstrong B.L.R., 4 12-c.m. do.	..	1884	..	11·00	—	—
cr.	**Trajano**	1400	210 2	29 6	wood	14 9	1	2400	7 4½-in. Whitworth B.L.R., 4 M. . .	..	1873	..	13·00	—	—
g.v.	**Ypiranga** . . .	420	131 3	24 7	wood	8 10	1	200	1 70-pdr. Whitworth, 2 32-pdr. s.b. .	..	..	..	9·0	—	—
corv.	**Vital de Oliveira** .	1402	203 7	36 1	wood	13 2	1	1000	4 70-pdr. Whitworth	..	1867	—	—	—	—

Double-screw gunboats.—Guarany, Forte de Coïmbra, Iniciadora, Pedro Affonso, Traripe, 250 to 33 tons; 160 to 260 I.H.P.

River-service gunboats. — Cabedello, Camocim, Cananéa, Carioca Marajó.

Paddle river-service gunboats.—Braconnot, Greenhalg, Henrique Martins, Lamego, Manáos, Taquary.

Paddle steamers.—Amazonas, Felippe Camarão, Fernandes Vieira, Henrique Diaz, Paraense, Tramandahy, Vidal de Negreiros.

Torpedo boats.—Four first-class; sixteen of smaller size.

Also Training and Harbour Ships and Transports.

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NOTES ON THE BRAZILIAN NAVY.

The Riachuelo.

(1) The Riachuelo carries four 20-ton breech-loading guns. The guns as first built and before they were bored out and re-rifled sent a steel projectile clean through 18 inches of iron armour, and had some energy to spare. These guns are so arranged that they can fire all round the horizon. Besides, there are six 70-lb. breech-loading rifled guns, and fifteen machine guns. The turret guns can be fired, all four together, ahead, astern, or on either beam. The compound engines, by Messrs. Humphreys and Tennant, have indicated 4537 horse-power for three hours' continuous working, during which the consumption was 1·38 lb. per horse-power per hour. With this power the ship steamed at the rate of over 15 knots an hour. When working with natural draught she has attained a speed of 16·238 knots, with 6900 horse-power. With only eight of her ten boilers in use, and a very moderate forcing of the draught, she has indicated 7300 horse-power, and attained a speed of 16·718 knots.

(2) The Aquidaban is of the same type, and has the same general appearance as the Riachuelo.

It was desired to reduce the draught of water, and changes were made from the Riachuelo design to effect this.

The Brazil and Lima-Barros.

(3) The Brazil and Lima-Barros are now employed as stationary floating batteries.

BULGARIA.

This principality is already in possession of the nucleus of a naval force in a flotilla of eleven steamers of small size, of which one is the Prince's Yacht.

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CHILI.—Armoured Ships.

c. b., central-battery ship; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery.					Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.b.	**Almirante Cochrane** (iron)	3500	210 0	45 9	9	8	7¾	19 8	2	2920	4 9-in. B.L.R. 18-ton Arm., 2 7-in. B.L.R.A. 4 l., 7 M.	..	1874	..	13·00	254	1900
c.b.	**Blanco Encalada** (iron)	3500	210 0	45 9	9	8	7¾	19 8	2	2920	6 12-ton Armstrong M.L.R., 4 l., 7 M.	..	1875	..	12·00	254	1900
t.	**Huascar** . . (iron)	2032	200 0	35 0	4½	5½ on turret	14	15 6	1	1050	2 10-in. 12½-ton Armstrong M.L.R., 2 40 pdr.	..	1865	..	12·00	100	—

CHILI.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; P., deck protected throughout.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.								£	knots.	tons.	knots.
corv.	**Chacabuco** . .	1101	218 6	33 4	wood	17 4	1	1200	3 8-in., 2 70-pdrs., 4 40-pdr. (all Armstrong)	..	1866	..	10·00	—	—
cr.	**Esmeralda** (1) P .	3000	270 0	42 0	steel	18 3	2	6500	2 25-ton Armstrong B.L.R., 6 6-in do., 2 Q.F., 6 M.	3 tu.	1884	..	18·28	600	2200
corv.	**Magellanes** . .	775	190 0	28 0	composite	14 9	1	1230	1 8-in., 1 64-pdr., 2 l. . . .	..	1874	..	11·00	—	—
„	**O'Higgins** . .	1100	218 6	33 4	wood	17 4	1	1200	3 8-in., 2 70-pdr., 4 40-pdr. (all Armstrong)	..	1866	..	10·00	—	—
„	**Pilcomayo** . .	600	171 0	27 4	wood	..	1	180 (nom.)	2 70-pdr., 4 40-pdr., 2 l. . .	..	1874	..	7·00	—	—

Paddle steamers.—Abtao, Valdivia (Training ship).

Gunboats.—Ancud, Diogenes, Independencia, Socrates, Tolten.

Torpedo boats.—Eleven.

Despatch Vessel.—Argant.

Transport.—Angamos.

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NOTES ON THE CHILIAN NAVY.

The Esmeralda

(1) The Esmeralda may be regarded as the natural development of Mr. George Rendel's idea of mounting heavy guns on comparatively small, but swift vessels. She has been designed by him so as to have "complete protection" of the vital parts, and adequate shelter from the fire of light machine guns in the loading stations, conning towers, &c. A thick, arched, protected deck runs from end to end, a little below water. Beneath this deck are the engines, boilers, steam-pipes, magazines, shell-rooms, &c. Above it are coal-bunkers, which add to the protection when filled. There are cork-filled cellular compartments extending nearly around the ship to aid buoyancy and stability when the vessel has been perforated at or below the water level. The main deck on which the officers and crew live is 5 or 6 feet above the protective deck. The upper or gun deck is 11 feet above water, and the axes of the heavy guns are 15 to 16 feet above it. About 60 feet from the bow a 25-ton 10-inch gun is mounted on a central-pivot carriage, with hydraulic mechanism for training, running out, &c. A steel screen is carried on the rear of the gun-slide and revolves with it. In it are the handles of the hydraulic mechanism and the elevating gear. From the floor of the protected "loading station" steel tubes run to the magazine and shell-room. About 60 feet from the stern a second 25-ton gun is mounted. There are three 6-in. 4-ton guns on each broadside, on central-pivot carriage, and protected by steel shields, which revolve with the guns. The guns are mounted on projecting sponsons, and so have an arc of training of 130 degrees. The Esmeralda also carries two 6-pounder Elswick quick-firing guns, several Hotchkiss and Gatlings. She has two masts, each with a light square rig and an armed top. The machinery is by R. and W. Hawthorn, and consists of two sets of horizontal compound engines driving twin screws. There are four double-ended boilers and two funnels. Forced draught can be used. The mean speed attained by the Esmeralda under forced draught was 18·28 knots per hour. At full speed her supply of 600 tons of coal would enable her to steam about 900 miles. At ten knots she could steam about 2200 miles. On the voyage out to the Pacific the Esmeralda proved herself to be a good sea-boat.

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CHINA.—Armoured Ships.

(The Chinese Navy is divided into Provincial Fleets: Canton, Foo-chow, Shang-hai, Peiho, and North Coast.)
a.g.b., armoured gunboat; *t.*, turret-ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Citadel.	Turret.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
t.	**Chen-Yuen** (1) . (steel)	7430	308 5	59 0	14 comp.	12 comp.	14	20 0	2	6200	4 30½-c.m. Krupp, 2 15-c.m. do., 2 l., 8 M.	2 tu.	1882	..	14·50	—	—
t.	**Ting-Yuen** (1) . (steel)	7430	308 5	59 0	14 comp.	12 comp.	14	20 0	2	6200	4 30½-c.m. Krupp, 2 15-c.m. do., 2 l., 8 M.	2 tu.	1881	..	14·50	—	—
a.g.b.	(*Tiong-Sing*) . (wood)	195	105 0	20 4	1⅛	3	5	7 0	2	340	1 17-c.m. Krupp . . .	..	1875	..	10·0	—	—
t.	(Two ships not named (steel)	2850	270 0	40 0	9½	9	—	16 0	2	3600	2 8¼-in. 10-ton B.L.R., 2 6-in. do.	..	Bldng.	..	15¼	325	—

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CHINA.—Unarmoured Ships.

cr., cruiser; *fr. cr.*, frigate-built cruiser; *g.v.*, gun-vessel; P., deck protected throughout; *pp*, partial deck protected.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Torpedoes.	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
fr. cr.	**Hai-An** . . .	2630	300 0	42 0	wood	21 0	1	1750	2 21-c.m. Krupp, 4 15-c.m. do., 20 12-c.m. do.	..	1872	..	12·00	—	—
g.v.	**Mei-Yun** . . .	578	170 0	22 9	composite	9 2	1	400	1 16-c.m. Vavasseur, 2 12-c.m. Vavasseur	..	1869	..	8·00	—	—
cr.	**Nan-Schuin** (2) . .	2200	253 0	36 2	steel	18 1	1	2400	2 8-in. Armstrong B.L.R., 8 4½-in. do. .	..	1884	..	15·00	—	—
„	**Nan-Thin** (2) . . .	2200	253 0	36 2	steel	18 1	1	2400	2 8-in. Armstrong B.L.R., 8 4½-in. do. .	..	1883	..	15·00	—	—
„	**Tshao-Yong** (3) *pp* .	1350	210 0	32 0	steel	15 8	2	2677	2 10-in. Armstrong B.L.R., 4 4½-in. do., 2 l., 6 M.	..	1881	..	16·80	300	5380 (at 8 knots)
g.v.	**Tshen-Hai** . . .	578	160 10	26 3	wood	10 6	1	480	1 6½-ton Armstrong M.L.R., 6 l. . .	..	1872	..	10·00	—	—
cr.	**Tshi-Yuen** (4) P . .	2355	236 3	34 5	steel	15 9	2	2800	2 21-c.m. (35 calibre) Krupp, 1 15-c.m. do., 4 l., 6 M.	4 tu.,	1883	..	15·00	—	—
g.v.	**Tsing-Yuen** . . .	578	160 10	26 3	wood	10 6	1	480	1 6½-ton Armstrong M.L.R., 6 l. . .	..	1872	..	10·00	—	—
cr.	**Yang-Wai** (3) *pp* . .	1350	210 0	32 0	steel	15 8	2	2400	2 10-in. Armstrong B.L.R., 4 4½-in. do., 2 l., 6 M.	..	1881	..	16·00	300	5370 (at 8 knots)
fr. cr.	**Yue-Yuen** . . .	2630	300 0	42 0	wood	21 0	1	1750	2 21-c.m. Krupp, 4 15-c.m. do., 20 12-c.m. do.	..	1873	..	12·00	—	—
cr.	(Two ships not named) P .	2300	267 0	38 0	steel	15 0	2	5500	3 8-in. 12-ton B.L.R., 2 6-in. 4-ton. do.	..	Building at Elswick.	..	18·00	450	—

Three cruisers of the Nan-Schuin and Nan-Thin type are being built at Foo-chow, and one at Kiang-nan near Shang-hai.

Gunboats (*Rendel's System*).—Alpha, Beta, Gamma, Delta, Fei-Ting, Iota, Kappa, Lambda, Lang-Sang, Tshin-Nan, Tshin-Pei. 260 to 440 tons; 180 to 380 I.H.P.

Gunboats (*Canton Flotilla*).—Ken-Che, Kuang-An, Li-Che, Ngan-Lan, Sar-Tsing, Tshen-To, Tshen-Yuen, Tshing-Tsing, Tshun-Tong, Tsing-An, Tsing-Po. 100 to 221 tons.

Floating Batteries.—Six with wooden fixed turrets for river service.

Torpedo boats.—Five for Whitehead torpedoes; six for spar-torpedoes; then others, class uncertain.

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NOTES ON THE CHINESE NAVY—ARMOURED AND UNARMOURED SHIPS.

(1) These ships were built by the Vulcan Company at Stettin. The principal dimensions are: length on the water-line, 308·4 feet; extreme breadth outside plating, 59 feet; displacement, 7430 tons. The main feature of the design consists of the armoured citadel, in which are placed two barbette turrets on a diagonal line with reference to the keel. The twin screws are driven by two three-cylinder horizontal compound engines of 6200 indicated horse-power. The speed is 14½ knots. Before and abaft the citadel the ships are divided into numerous water-tight compartments. In the vicinity of the water-line the compartments are filled with cork. The armament consists of four 30½ centimetre (= 12 inches) Krupp guns, mounted in the two barbette towers on turntables. In addition to these one gun can be mounted under the poop, and another in the forecastle. The citadel and turrets are protected by 14-inch and 12-inch compound plating respectively. **Chen-Yuen and Ting-Yuen.**

(2) On the 8th January, 1884, the Nan-Shuin was launched at Kiel from the Howaldt ship-building yard. On the 12th December, 1883, another corvette of the same type, the Nan-Thin, was launched at the same port. The Nan-Shuin is constructed throughout of steel. She is rigged as a barque and armed with two 21-c.m. guns and eight 12-c.m. Armstrongs. She also carries machine guns as a protection against torpedo boats. The machinery develops 2400 I.H.P., giving a speed of from 14½ to 15 knots. **The Nan-Shuin and Nan-Thin.**

(3) In 1881 Messrs. Sir G. W. Armstrong & Co. supplied the Chinese Government with the swift cruisers Yang Wai and Tshao-Yong, which were built of steel, at Messrs. Mitchell's yard on the Tyne. **The Yang Wai and Tshao Yong.**

The hulls of these cruisers are of the following dimensions:—Length between the perpendiculars, 210 feet; breadth of beam, 32 feet; depth of hold, 21 feet 9 inches; draught of water, 15 feet 8 inches; displacement, 1350 tons. They are propelled by twin screws driven by compound engines of, together, 2600 indicated horse-power, from the works of Messrs. Hawthorn. They each carry two 10-inch breech-loading Armstrong guns, mounted upon centre pivots, one forward and one aft, also four 4¾-inch, and two 9-pounder breech-loaders, besides Nordenfelts and Gatlings. The engines, boilers, magazines, &c., are entirely below the water-line, and protected by a steel-plated deck and coal bunkers. The capacity of the bunkers

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is 300 tons of coal, and with that quantity the vessels can run continuously at a speed of about eight knots for four weeks together. The results obtained on the trial trip were—for the Yang Woi, 2580 indicated horse-power, and a speed of 16 knots; and for the Tshao-Yong, 2677 horse-power and 16·8 knots.

The Tshi-Yuen.

(4) The Tshi-Yuen has an armoured under-water deck from end to end, and internal 10-in. compound armour.

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DENMARK.—Armoured Ships.

b.c., belted cruiser; *br.*, broadside ship; *c.s.*, coast-service vessel; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery or Turret.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
b.c.	**Absalon** . . .	527	150 0	26 0	2	2	6	10 2	1	500	6 8·7 in. Krupp, 2 M. . .	..	1862	..	10·00	—	—
br.	**Denmark** . . .	4747	270 0	49 6	4½	4½	18	19 10	1	1007	12 8-in. Armstrong M.L.R., 12 6-in. Finspong.	..	1864	260,000	8·00	625	—
Torpedo School Ship	**Esbern Snare** . .	527	150 0	26 0	2	2	6	10 2	1	500	2 M.	1 tu.	1862	..	10·00	—	—
c.s., *t.*	**Gorm**	2344	231 0	40 0	7	8 turret	10	13 9	1	1670	2 10-in. Armstrong M.L.R., 3 8·7-c.m. Krupp, 4 M.	..	1870	104,000	12·25	115	—
t.	**Helgoland** . . .	5347	257 6	59 2	12	10	10	18 8	2	4000	1-30½-c.m. Krupp 4 26-c.m. do., 5 12½-c.m. do.	4 tu.	1878	275,000	12·00	230	1070
b.	**Iver Hvitfeldt** (1) (steel)	3260	242 0	49 6	1½	8½	..	18 0	2	5000	2 26-c.m. Krupp, 4 12-c.m. do., 10 M.	4 tu.	1885	200,000	15·00	250	—
c.s., *t.*	**Lindormen** . . .	2076	216 0	39 5	5	5½ turret	9¾	13 9	2	1560	2 9-in. Armstrong M.L.R., 3 8·7-c.m. Krupp 4 M.	..	1868	93,000	12·00	120	—
„	**Odin**	3083	237 0	54 6	8	8	10	15 6	1	2260	4 10-in. Armstrong M.L.R., 4 8·7 c.m. Krupp 6 M.	..	1872	147,000	12·40	180	560
br.	**Peder Shram** (wood) .	3373	220 0	48 5	5	4½	..	20 7	1	1680	8 8-in. Armstrong M.L.R., 8 6-in. Finspong, & 12·26 do.	..	1864	..	11·70	300	1589
t.	**Rolf Krake** . . .	1344	185 2	38 3	4	4½	9	10 6	1	750	2 8 in. Armstrong, 2 8·7 c.m. Krupp 4 M. . . .	..	1863	74,000	7·80	135	—
Torpedo Ship	**Tordenskiold** . .	2400	221 6	43 3	Armour on deck 4 in. to 2 in.	8 (steel)	..	15 6	..	2600	1 30½-c.m. Krupp, 4 12-c.m. do., 6 M.	4 tu.	1880	138,900	14·00	170	—

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DENMARK.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *fr. cr.*, frigate-built cruiser; *g.v.*, gun-vessel; P., deck protected throughout.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
corv.	**Dagmar** . . .	1193	173 10	33 10	wood	16 0	1	800	8 12-c.m. Krupp, 2 M. . .	..	1861	50,000	9·50	150	—
g.v.	**Diana**	556	154 6	26 3	wood	10 2	1	500	6 8·7-c.m. Krupp, 2 M. . .	..	1863	33,000	10·00	60	—
„	**Falster** . . .	356	111 0	28 10	iron	7 6	1	510	1 10-in. Armstrong M.L.R., 2 8·7-c.m. Krupp, 2 M. . . .	..	1873	33,000	9·80	—	—
fr. cr.	**Fyen** (?) . . .	2596	226 6	45 6	steel and iron	18 1	1	2700	4 long 15-c.m. Krupp, 14 short do., 6 M.	2 tu.	1882	170,000	13·00	290	—
g.v.	**Fylla**	556	154 0	26 3	wood	10 2	1	500	6 8·7-c.m. Krupp, 2 M. . .	..	1862	33,000	10·00	60	—
corv.	**Heimdal** . . .	1192	173 10	31 6	wood	16 0	1	750	14 5½-in. Finspong, 2 M. . .	..	1856	..	9·00	—	—
g.v.	**Ingolf**	870	192 0	18 0	iron	12 6	1	670	3 15-c.m. Krupp, 2 M. . .	..	1876	44,000	10·50	130	—
fr. cr.	**Jylland** . . .	2457	200 3	44 3	wood	19 5	1	1350	20 6-in. Finspong, 6 12-c.m. Krupp, 4 M.	..	1860	84,000	11·00	261	—
g.v.	**Moen**	356	111 0	28 0	iron	7 6	1	523	1 10-in. Armstrong M.L.R., 2 8·7-c.m. Krupp, 2 M.	..	1875	..	9·20	—	—
corv.	**Saint Thomas** . .	1572	224 0	33 0	wood	17 0	1	1870	1 8-in. Armstrong M.L.R., 4 12-c.m. Krupp, 3 M.	..	1871	..	13·60	—	—
Torpedo Storeship.	**Sleipner** . . .	..	..	..	..	..	2	—	—	—	—	—	—	—	—
cr.	Valkyrien* P. . . .	2900	268 0	43 6	steel	18 0	2	5000	2 long 21-c.m. Krupp, 6 15-c.m. long Krupp, 10 M. . .	5 tu.	Bldg.		17·00	450	—

* 2½ ins. steel deck under water through the whole length of the ship.

Gunboats.—Eleven in number, of 47 to 238 tons; 40 to 400 I.H.P. *Torpedo boats* (*first class*).—Five, and five to be built.

Torpedo boats (*second class*).—Nine, and thirteen to be built.

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(1) The Iver Hvitfeldt. This ship is to have two armoured barbette-turrets, each carrying a 26-c.m. Krupp gun, and an unarmoured battery with four 12-c.m. Krupp guns. The speed is to be at least 15 knots. The Iver Hvitfeldt.

(2) The Fyen is a frigate-built or main-decked corvette, built of steel and iron. The Fyen.

EGYPT.

Besides yachts and transports there are on the list of the Egyptian Navy the names of two frigates, one corvette, and four despatch-vessels. The larger of these are not in a state to be of much use in war.

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FRANCE.—Armoured Ships.

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship.
Where no material is mentioned the hull is of iron.

Class.	NAME.	Displacement.	Length at Water Line.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery or Turret.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.		Natural Draught.				£	knots.	tons.	knots.
a.g.b.	Achéron* . (steel)	1640	181 0	40 4	..	..	..	11 10	2	..	1 27-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1885	—	13·00	—	—
c.b.	Alma (*d*) . (wood)	3770	229 10	46 6	5⅞	4¾	26	23 11	1	1896	6 19-c.m. B.L.R., 4 12-c.m. do.	..	1867	101,200	11·89	—	—
b.	Amiral Baudin (1) (iron & steel)	11,380	321 6	69 10	21½	16½ steel	14	26 2	2	6500 8320 forced draught.	3 37-c.m. (75 ton) B.L.R., 12 14-c.m. do., 8 M.	tu.	1883	600,000	15·00	800	3000
b.	Amiral Duperré (iron & steel)	11,100	311 0	66 11	21½	15½	14	26 9	2	5783 8000 forced draught.	4 34-c.m. (48 ton) B.L.R., 14 14-c.m. do., 12 M.	tu.	1879	570,000	14·22	—	—
c.b.	Atalante (*d*) (wood)	3800	229 10	46 6	6	4¾	26	23 3	1	1640	8 19-c.m. B.L.R., 4 12-c.m. do., 6 M.	..	1868	..	11·43	—	—
b.	Bayard . (wood)	5881	265 9	57 2	10	8	15	24 11	2	4556	4 24-c.m. B.L.R., 2 19-c.m. do., 6 14-c.m., 2 l., 12 M.	..	1880	..	14·53	—	—
c.s., t.	Bélier . (wood)	3600	196 10	53 0	8½	7	31½	19 1	2	1921	2 24-c.m. B.L.R. . . .	..	1870	..	12·37	—	—
c.s.b.	Belliqueuse (*d*)(wood)	3706	230 0	46 3	6	4¾	26	22 10	1	1227	4 19-c.m. B.L.R., 4 16-c.m. do., 4 14-c.m. do., 6 M.	..	1865	99,176	11·78	—	—
c.s., t.	Bouledogue (wood)	3400	196 10	53 0	8½	7	31½	18 2	2	1827	2 24-c.m. B.L.R. . . .	..	1872	..	12·25	—	—
b.	Brennus (2) (steel)	10,600	344 6	64 0	17½ comp.	17¼ comp.	..	26 9	3	5500	4 34-c.m. B.L.R., 8 14-c.m. do., 7 M.	..	..	..	15·00	—	—
c.s.b.	Caiman(5) (iron and (steel)	7230	278 3	59 0	19½	17¾	12	24 7	2	6000 8000 forced draught.	2 42-c.m. B.L.R., 4 10-c.m. do., 4 M.	..	1885	..	14·50	—	—
c.s., t.	Cerbère . (wood)	3800	196 10	53 0	8½	7	31½	19 7	2	1800	2 24-c.m. B.L.R. . . .	..	1868	137,600	11·39	—	—
b.	Charles Martel (2) .	10,650	344 6	64 0	17¼	17¼	..	26 9	3	5500	4 34-c.m. B.L.R., 8 14-c.m. do., 7 M.	..	..	..	15·00	—	—
a.g.b.t	Cocyte . (steel)	1640	181 0	40 4	..	..	..	11 10	2	..	1 27-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	Bldg.	..	13·00	—	—

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c.b.	**Colbert** . (wood)	8457	317	9	56	6	8½	6½	34	28	5	1	4652	8 27-c.m. B.L.R., 6 24-c.m. do., 6 14-c.m. do., 8 M.	..	1875	..	14·47	700	—
c.b. & b.	**Courbet** (iron & steel), formerly called Foudroyant.	9700	312	0	67	0	15	9½	..	25	0	2	8200	4 34-c.m. B.L.R., 4 27-c.m. do., 6 14-c.m. do., 22 M.	5 tu.	1882	800,000	15·00	628	3100
c.b. & b.	**Dévastation** (iron & steel)	10,100	312	0	67	0	15	9½	12½	25	0	2	8320	4 34-c.m. B.L.R., 4 27-c.m. do., 18 14-c.m. do., 8 M.	..	1879	..	15.17	610	2800
b.	**Duguesclin** . (iron)	5869	266	0	57	0	9⅞	7⅞	15	25	3	2	3300	4 24-c.m. B.L.R., 1 19-c.m. do., 6 14-c.m. do., 4 M.	..	1882	220,000	14·00	400	—
a.g.b. & b.	**Flamme** (*c*) (special metal)	1045	165	0	32	7	10	..	..	10	4	..	..	1 27-c.m. B.L.R., 1 l., 2 M. [6 M.	1 tu.,	1885	68,000	13·00	—	—
c.b.	**Flandre** (*d*) . .(wood)	5997	295	3	56	6	6	4½	26	27	6	1	3536	8 24-c.m. B.L.R., 5 19-c.m. do., [8 M.	..	1864	213,280	13·30	—	—
b.	**Formidable**(1) (steel)	11,441	319	4	68	3	21½	17⅜	14	26	2	2	6500 8320 forced draught.	3 42-c.m. B.L.R., 12 14-c.m. do., 8 M.	..	1885	467,520 hull, 85,800 machinery.	15·00	—	—
c.b. & b.	**Friedland** . .	8540	317	0	58	0	8	7	15	29	11	1	4428	8 27-c.m. B.L.R., 8 14-c.m. do.,	..	1873	..	13·30	—	—
c.s., t.	**Fulminant** (iron and steel)	5574	248	0	57	9	13	12	16	21	4	1	3550	2 27-c.m. B.L.R., 4 12-c.m. do., 4 M.	..	1877	..	13·22	—	—
c.s., b.	**Furieux** (iron & steel)	5560	247	10	59	0	20	17¾	..	21	9	2	4000	2 34-c.m. B.L.R., 4 10-c.m., 4 M.	..	1883	264,640	14·00	290	1500
a.g.b. & b.	**Fusée** (*c*) . (steel)	1045	165	0	32	7	10	..	..	10	4	2	1500	1 24-c.m. B.L.R., 1 l., 2 M.	1 tu.	1884	68,000	13·00	—	—
,,	**Grenade** (*c*) . (steel)	1045	165	0	32	7	10	..	..	10	4	..	..	1 27-c.m. B.L.R., 1 l., 2 M.	1 tu.	Bldg.	68,000	13·00	—	—
a.c.	**Guerrière** . .	—	—	—			—	—	—	—	—	—	—	—	—	—	—	—	—	—
c.b.	**Héroine** . (iron)	5887	262	5	56	0	6	4½	26	27	7	1	3318	8 24-c.m. B.L.R., 3 19-c.m. do., 2 14-c.m. do., 3 12-c.m. do., 6 M.	..	1863	213,000	13·00	—	—
b.	**Hoche** (1) (iron & steel)	10,650	320	0	65	7	18	16	..	27	3	2	5500 say 7000 forced draught	2 34-c.m. B.L.R., 2 27-c.m., 18 14-c.m. do., 8 M.	4 tu.	..	380,000 hull, 120.000 machinery	15·00	600	3500 at 11
Armoured floating battery	**Imprenable** (*d*) (iron)	1420	129	6	51	10	5½	4½	16	11	3	2	411	2 24-c.m. B.L.R., 2 16-c.m. do., 2 12-c.m. do.	..	1867	..	5·51	—	—
c.s., b.	**Indomptable** (iron and steel	7168	279	10	59	0	20	18	..	23	6	2	6000	2 42-c.m. (75-ton) B.L.R., 4 10-c.m., 4 M.	..	1883	..	14·50	—	—
c.b. & b.	**La Galissonnière** (wood)	4700	255	8	49	0	6	4¾	26	23	9	2	2370	6 24-c.m. B.L.R., 4 12-c.m. do., 6 M.	..	1872	..	13·08	—	—
b.	**Magenta** (1) (iron and steel)	10,581	330	0	65	7	18	16	..	27	3	2	5500 say 7000 forced draught	2 34-c.m. B.L.R., 2 27-c.m. do., 20 14-c.m. do., 20 M.	4 tu.	Bldg.	380,000 hull, 120.000 machinery.	15·00	600	3500 at 11

* The Acheron is built of steel; she has two screws, and an armoured belt at the water-line. Her 27-c.m. gun is carried on a barbette-turret.

(*d*) According to a statement made by the Minister of Marine in 1886, the eight ships so marked are condemned as unfit for further service at sea.

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FRANCE.—Armoured Ships—*continued.*

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship.
Where no material is mentioned the hull is of iron.

Class.	NAME.		Displacement.	Length at Water Line.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
						Belt.	Battery or Turret.					Guns.	Torpedoes.					
			tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.		Natural draught.				£	knots.	tons.	knots.
b.	**Marceau** (3)	(iron & steel)	10,581	330 0	65 7	18	16	..	27 3	2	5518 say 7000 forced draught	2 34-c.m. 50-ton B.L.R., 2 27-c.m. 23 ton do., 20 14-c.m. do., 20 M.	4 tu.	..	380,000 hull, 120,000 machinery.	15·00	600	3500 at 11
c.b. & b.	**Marengo** .	(wood)	7187	282 6	56 10	8	6¼	32	27 8	2	3673	6 27-c.m. B.L.R., 4 24-c.m. do., 4 12-c.m. do.	..	1869	280,000	13·49	650	—
a.g.b. & b.	**Mitraille** (6)	(steel)	1045	165 0	32 7	10	..	..	10 4	..	..	1 27-c.m. B.L.R., 1 l., 2 M. .	..	Bldg.	68,000	13·00	—	—
c.b.	**Montcalm**	(wood)	3621	230 3	46 1	5⅞	4¾	26	23 7	1	1830	6 19-c.m. B.L.R., 6 10-c.m., do., 8 M.	..	1868	..	11·65	—	—
b.	**Neptune** (3)	(iron & steel)	10,581	330 0	65 7	18	16	..	27 3	2	5500 say 7000 forced draught	2 34-c.m. B.L.R., 2 27-c.m. 23 ton B.L.R., 20 14-c.m. do., 20 M.	..	..	..	15·00	600	3500 at 11
c.b. & b.	**Océan** .	(wood)	7500	282 6	56 10	8	6¼	32	27 3	2	3781	4 27-c.m. B.L.R., 4 24-c.m. do., 4 12-c.m. do., 8 M.	..	1868	..	13·70	—	—
c.s., t.	**Onondaga** . .		2600	228 4	51 2	5	12⅜	12	12 7	..	642	4 24-c.m. B.L.R. . . .	..	1863	..	6·46	—	—
Armoured floating battery	**Opiniâtre.** . .		1359	131 3	48 5	4½	4½	15¾	9 6	2	457	4 19-c.m. B.L.R., 1 l. . .	..	1864	..	6·98	—	—
a.g.b., t.	**Phlégéthon**	(steel)	1640	181 10	40 4	..	..	..	11 10	2	..	1 27-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	Bldg.	..	13·00	—	—
Armoured floating battery	**Protectrice** (*d*) .		1420	129 6	51 10	5½	4¼	15¾	12 0	2	..	4 19-c.m. B.L.R., 1 l. . .	..	1866	..	6·0	—	—
c.b.	**Provence** (*d*)	(wood)	5819	262 5	55 10	6	4¼	26	27 2	2	3064	8 24-c.m. B.L.R., 3 19-c.m. do., 2 14-c.m. do., 3 12-c.m. do.	..	1863	..	13·70	—	—
c.b. & b.	**Redoutable**	(iron & steel)	9200	318 2	64 8	14	9½	15	25 6	2	6071	8 27-c.m. B.L.R., 6 14-c.m. do., 8 M.	..	1876	..	14·66	510	280

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c.b.	**Reine Blanche**	(wood)	3900	230	3	46	2	6	4¾	26	23	8	1	1860	6 16-c.m. B.L.R., 4 12-c.m. do., 6 M.	..	1868	..	11·80	—	—
c.s., b.	**Requin** (*c*) .	(iron & steel)	7200	279	10	59	0	19½	17¾	..	24	7	2	6000	2 42-c.m. B.L.R., 4 10-c.m. do., 4 M.	..	1885	..	14·00	—	—
c.b.	**Revanche**	(wood)	5819	262	5	55	10	6	4¼	26	27	1	2	3187	8 24-c.m. B.L.R., 3 19-c.m. do., 2 14-c.m. do., 3 12-c.m. do.	..	1865	..	13·25	—	—
c.b. & b. t.	**Richelieu**	(wood)	9100	323	6	57	10	8½	6¼	..	27	11	2	4006	6 27-c.m. B.L.R., 5 24-c.m. do., 8 14-c.m. do., 12 M.	..	1873	..	13·11	—	—
c.b.	**Savoie** .	(wood)	6000	262	5	55	10	6	4¼	26	28	0	1	3318	8 24-c.m. B.L.R., 3 19-c.m., 2 14-c.m. do.	..	1864	..	13·47	—	—
a.g.b.	**Styx** .	(steel)	1640	181	10	40	4	..	..	..	11	10	2	..	1 27-c.m. B.L.R., 2 10-c.m., 2 M.	..	Bldg.	..	13·00	—	—
c.b. & b.	**Suffren** .	(wood)	7600	282	6	57	10	8	6¼	32	29	10	1	4288	4 27-c.m. B.L.R., 4 24-c.m. do., 6 14-c.m. do., 12 M.	4 tu.	1870	..	14·30	—	—
c.b.	**Surveillante**	(wood)	5758	262	5	56	4	6	4¼	26	29	1	1	3254	8 24-c.m. B.L.R., 4 19-c.m. do., 4 14-c.m. do.	..	1864	..	13·20	—	—
c.s., b.	**Taureau** .	(wood)	2700	194	9	47	3	6	4¾	26	17	9	2	1805	1 24-c.m. B.L.R. . . .	..	1865	..	12·54	—	—
c.s., t.	**Tempête**	(iron & steel)	4523	248	0	57	9	13	12	15¾	16	9	1	1745	2 27-c.m. B.L.R., 4 M. . .	..	1876	..	12·80	—	—
c.s., b.	**Terrible**	(iron & steel)	7200	279	10	59	0	19½	17¾	..	24	7	2	6000	2 42-c.m. B.L.R., 4 10-c.m. do., 4 M.	..	1881	..	14·50	—	—
c.b.	**Thétis** .	(wood)	3621	230	3	46	2	6	4¾	26	20	10	1	1859	6 16-c.m. B.L.R., 4 12-c.m. do., [6 M.	..	1877	..	11·99	—	—
c.s., t.	**Tigre** .	(wood)	3500	216	6	52	10	9	7	..	18	9	2	1880	2 24-c.m. B.L.R. . . .	..	1871	..	12·09	—	—
c.s., b.	**Tonnant**	(iron & steel)	4707	248	7	58	5	13	12	15¾	17	3	1	1760	2 34-c.m. B.L.R., 2 27-c.m. do., 4 M.	..	1880	..	11·00	—	—
c.s., t.	**Tonnerre**	(iron & steel)	5574	248	0	57	9	13	12	15¾	21	4	1	4165	2 27-c.m. B.L.R., 4 10-c.m. 4 M.	..	1875	..	14·01	—	—
c.b. & b.	**Trident** .	(wood)	8800	317	9	56	4	8½	6¼	34	29	1	1	4652	8 27-c.m. B.L.R., 2 24-c.m. do., 4 14-c.m. do., 4 M.	..	1876	..	14·17	—	—
,,	**Triomphante**	(wood)	4700	258	2	48	9	6	4¾	26	22	5	1	2200	6 24-c.m. B.L.R., 3 19-c.m. do., 6 14-c.m. do.	..	1877	..	12·89	—	—
b.	**Turenne** .	(wood)	6400	265	9	57	2	10	8	15	23	11	2	3300	4 24-c.m. B.L.R., 2 19-c.m. do., 6 14-c.m. do., 12 M.	..	1879	..	14·14	—	—
c.b.	**Valeureuse** (*d*)	(wood)	5774	262	5	56	4	6	4¼	..	27	6	1	3383	8 24-c.m. B.L.R., 1 19-c.m. do., 6 16-c.m. do., 1 12-c.m. do.	..	1864	..	13·83	—	—
b.	**Vauban** . . .		5900	267	9	57	3	10	8	15	24	10	2	3300	4 24-c.m. B.L.R., 1 19-c.m. do., 6 14-c.m. do., 12 M.	..	1882	..	14·32 forced draft.	400	—
c.s., t.	**Vengeur**	(iron & steel)	4523	248	0	57	9	13	12	15¾	16	9	2	2319	2 27-c.m. B.L.R., 4 M. . .	..	1878	..	10·83	—	—
c.b. & b.	**Victorieuse**	(wood)	4600	258	2	48	9	6	4¾	26	22	5	1	2214	6 24-c.m. B.L.R., 1 19-c.m. do., 6 14-c.m. do.	..	1875	..	12·75	—	—

(*d*) According to a statement made by the Minister of Marine in 1886, the eight ships so marked are condemned as unfit for further service at sea.

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NOTES ON THE FRENCH NAVY.

Amiral Baudin.

The Amiral Baudin.

(1) The Amiral Baudin was laid down on the 10th January, 1879, and launched at Brest on the 5th June, 1883. The ship is built of iron and steel, and is similar in type to the Formidable. There are no rigged masts.

The Amiral Baudin has twin screws, propelled by three cylinder compound engines, which will realise with forced draft 8320 I.H.P. The boilers are twelve in number, with 36 furnaces. The thwartship water-tight bulkheads are eleven in number, and carried up to the armoured deck, which is 3 ft. 7 in. above the water line. There are also several water-tight longitudinal bulkheads.

The Amiral Baudin is only partially armoured. An armour belt of steel plates extends from end to end of the ship. The extreme thickness of the armour amidships is 22 inches, diminishing at the bow and stern to 14 inches. The armour is fixed to a teak backing of from 12 to 14 inches in thickness, and is secured by bolts on the Schneider system. The three pear-shaped turrets in which the heavy guns are mounted are protected by 16-inch steel armour.

The thickness of the armour on the armoured deck is three inches, increasing to four inches over the machinery and boilers. The armoured shafts for passing up the ammunition are seven feet in diameter.

The armament of the Amiral Baudin consists of three 75-ton breech-loading guns of the latest pattern, mounted in the turrets en barbette. Twelve 14-centimetre guns are mounted on the broadside, and so fitted that all can be fired from either broadside. The original plan of armament included 8 Hotchkiss guns, but it is in contemplation to increase the number. The turret guns are protected against machine guns by umbrella-shaped shields.

Brennus and Charles Martel.

Brennus and Charles Martel

(2) Brennus and Charles Martel. The Austrian *Almanach für die K. K. Marine*, 1886, states (p. 128) that the construction of these two ships as armour-clads has been discontinued, and that both are to be converted into transports.

Marceau.

The Marceau.

(3) The Marceau was launched on the 16th January, 1884, at la Seyne, from the establishment of the Société des Forges et Chantiers.

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de la Méditerranée. This vessel is protected with compound armour, and is fitted with barbette towers and twin screws.

The hull is built on the cellular system, having a double bottom. The outer bottom is constructed of iron up to the armour shelf. The upper works are of steel plates. Iron has been preferred to steel below the water. For the upper works the use of steel secures a considerable economy of weight. The armour belt has a thickness of 12 inches at the lower edge, and 18 inches at the upper edge. The armoured deck has a thickness of 3 inches. The ship is subdivided internally by 13 transverse bulkheads. The hull is further subdivided into 17 lateral compartments, more or less further subdivided by the transverse and horizontal bulkheads of the internal fittings. By these arrangements it is claimed that the utmost quantity of water which could be admitted by any single explosion of a torpedo is limited to 250 tons.

The water-line belt is fixed to a teak backing, which again rests upon a double-inside skin.

The turrets, four in number, will be protected with 16-inch plates. Two of these turrets are amidships, and at the sides of the ship another is forward, and the fourth abaft. Each turret will rest upon a platform, supported by an armoured tube, which transmits the pressure of the superincumbent weight to the main deck, and communicates with the magazines by an armoured shaft.

The armament of the Marceau will consist of two 50-ton guns, mounted in the bow and stern turrets, and of two 23-ton guns mounted on the turrets amidships. Two 2½-ton guns will be mounted on the upper deck, and 18 guns of the same calibre in the battery. The armament will include 20 Hotchkiss guns and 4 torpedo launching tubes, two amidships and two astern. The turrets will be covered with a steel shield, two inches in thickness, as a protection to the gun's crew from the fire of machine guns and musketry.

The ship is rigged with three lower masts with light top-masts, but will carry fore and aft canvas only.

Three other ironclads of the same type as the Marceau are actually in construction; the Hoche at L'Orient, the Neptune at Brest, and the Magenta at Toulon. The cost of the hull of vessels of this type, including material and labour, is given in the Budget for 1884 at £380,000; the machinery will cost £120,000. To these figures should be added the cost of the armament, which cannot be estimated at less than £80,000; thus the Marceau, fit for sea, will have cost £600,000.

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Caiman.

The Caïman.

(4) The twin-screw armour-clad Caïman was launched from Mourillon Dockyard the 21st May, 1885. She has been on the stocks for the last seven years, and two or three more years will be required to complete her. The armour consists of Creusôt steel plates with a maximum thickness of just under 20 in. (50 centimetres), and this thins out at the bow and stern. The vital parts are protected by a steel deck with plates 2·8 in. (7 centimetres) thick, supported by a wood backing 12 in. thick. The main engines are supplied with steam by twelve boilers in four groups, each separated by water-tight compartments. The speed expected is 14½ knots. The weight of machinery and equipment will be over 2000 tons, towards which the machinery contributes 1200 tons and the armament 450 tons.

The Caïman carries two 42-c.m. guns, each placed in a barbette turret partly sheltered above the turret by a steel shield. On the deck there are 4 10-c.m. guns and several machine-guns.

Requin.

The Requin.

(5) The Requin was launched at Bordeaux in June, 1885. The outer plating is iron, the rest of the hull is built of steel.

Fusée.

The Fusée.

(6) The Fusée was launched from L'Orient on May 7th, 1884, having been commenced at the end of 1882. She may be described as a small turret ship with a double screw, mastless, and built of steel and iron.

The hull is protected by a belt of an extreme thickness of ten inches at the upper edge of the belt, and seven inches at the lower edge. The deck will be protected by 2-inch plating. All the hatchways and air-shafts will be similarly protected. The buoyancy is further assured by a number of water-tight compartments, and by a coffer-dam carried all round the deck. Forward a shield is fixed, protected with 4-inch plating. The total weight of the armour will be 333 tons. Armament—one 27-c.m. gun mounted forward in a turret, one light gun, and two Hotchkiss guns. A tube will be fitted for the discharge of Whitehead torpedoes. The machinery will be 1500 H.P. The estimated speed is 13 knots. Complement, 70.

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Estimated cost—for the hull, £43,200; for the machinery, £21,000. Total cost of these gun-boats, about £68,000.

It is understood from statements made in the French Chamber that the following ships have been condemned as unfit for further service, viz., Alma, Atalante, Belliqueuse, Flandre, Imprenable, Protectrice, Provence, Valeureuse. The Protectrice has been used as a target for torpedoes, and a hole has been blown in her side.

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FRANCE.—Unarmoured Ships.

The divisions of the French unarmoured ships follow the official classification. The designation of each class is made, wherever practicable, to correspond with the usual parallel English equivalent. The French system of nomenclature is based on two distinct principles—that of the design of a ship, and that of the service for which a ship is intended. *Eclaireurs d'Escadre* are classed as sloops, that being the nearest English equivalent. *Avisos* are classed as despatch vessels to distinguish them from the *Canonières de Station*, classed as gun-vessels, which they resemble more closely than they do the British Helicon. The *Canonières de Station* differ little from British gun-*boats* of the Espoir class; they have been classed as gun-*vessels* to distinguish them from the several kinds of French gun-boats.

cr., cruiser; *d.v.*, despatch vessel; *fr.c.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; *s.g.to.*, sea-going torpedo boat; *to.cr.*, torpedo cruiser; *to.g.v.*, torpedo gun-vessel; P, deck protected throughout.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
fr.c.	**Aréthuse**	3400	277 6	43 6	wood	21 9	1	4200	4 16-c.m. B.L.R., 23 14-c.m. do., 8 M.	..	1882	—	14·00	—	—
g.v.	**Aspic**	480	145 4	23 10	composite	10 6	1	453	2 14-c.m. B.L.R., 2 10-cm. do.	..	1880	..	10·30	—	—
s.g.to.	**Balny** (1)	70	131 0	10 10	steel	4 5	..	..	2 M.	..	..	..	22·00	—	—
sl.	**Beautemps-Beaupré**	1350	204 8	34 2	wood	15 10	1	985	5 14-c.m. B.L.R., 4 M.	..	1872	..	12·60	—	—
d.v.	**Bisson**	880	199 5	28 5	wood	12 8	1	849	3 14-c.m. B.L.R., 1 10-c.m. do., 5 M.	..	1874	..	11·78	—	—
to.g.v.	**Bombe** (1)	320	196 10	21 7	steel	5 11	2	1800	2 l., 3 M.	2 tu.	1885	..	18·00	—	—
s.g.to.	**Bouet Willaumez** (1)	70	131 0	10 10	steel	4 5	..	..	2 M.	..	..	..	22·00	—	—
sl.	**Bougainville**	800	182 0	31 9	wood	12 9	1	449	6 12-c.m. B.L.R.	..	1859	..	9·34	—	—
d.v.	**Bourayne**	1290	204 8	34 4	wood	15 10	1	768	6 14-c.m. do., 2 M	..	1869	..	11·20	—	—
d.v.	**Boursaint**	780	198 4	28 0	wood	12 8	1	679	1 16-c.m. B.L.R., 2 14-c.m. do.	..	1872	..	11·51	—	—
„	**Bouvet**	870	197 6	28 0	wood	12 2	1	817	3 14-c.m. B.L.R., 1 10-c.m. do., 3 M.	..	1876	..	11·39	—	—
„	**Bruat**	770	182 5	28 0	wood	12 10	1	557	3 14-c.m. B.L.R., 1 10-c.m. do., 3 M.	..	1867	..	10·76	—	—
s.g.to.	**Capitaine Cuny** (1)	70	131 0	10 10	steel	4 5	..	..	2 M.	..	1885	..	22·00	—	—
„	**Capitaine Mehl** (1)	70	131 0	10 10	steel	4 5	..	..	2 M.	..	..	..	22·00	—	—
g.v.	**Capricorne**	480	148 4	23 10	wood	10 5	1	443	2 14-c.m. B.L.R., 2 10-c.m. do.	..	1882	..	11·18	—	—
fr.c.	**Cecille** (2) P.	5766	378 9	49 3	iron and steel	19 9	2	9600 (forced draught)	6 16-c.m. B.L.R., 10 14-c.m. do., 3 Q.F., 10 M.	4 tu.	Building.	hull, 181,666; engines, 116,000.	19·00	—	—

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g.v.	**Chaca**	460	142	6	24	4	wood	9	5	2	251	1 14-c.m. B.L.R., 1 12-c.m., 2 M.	..	..	..	9·13	—	—
cr.	**Champlain**	2000	258	10	35	8	wood	21	8	1	1953	1 16-c.m. B.L.R., 9 14-c.m. do.	..	1872	..	14·29	—	—
s.g.to.	**Challier**	70	131	0	10	10	steel	4	5	..	..	2 M.	..	..	..	22·00	—	—
d.v.	**Chasseur**	930	199	5	28	5	wood & iron	12	7	1	850	4 14-c.m. B.L.R.	..	1878	..	11·06	—	—
cr.	**Château Renault**	1875	262	2	35	3	wood	18	2	1	1701	7 14-c.m. B.L.R.	..	1868	..	14·27	—	—
cr.	**Clorinde**	1800	..		..		..	..		..	..	16 14-c.m. B.L.R.	—	—	—	—	—	—
g.v.	**Comete**	495	151	6	24	9	composite	10	6	1	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1884	..	..	—	—
to.cr.	**Condor** (1)	1280	216	6	29	3	steel	15	5	2	200 0& 3200 (forced draught)	5 10-c.m. B.L.R., 6 M.	5 tu.	1885	..	17·00	—	—
d.v.	**Corse**	520	148	7	27	11	wood	11	10	1	276	1 19-c.m. B.L.R., 2 10-c.m. do.	..	1842	..	10·15	—	—
g.v.	**Crocodile**	450	141	10	24	0	composite	9	5	1	441	2 14-c.m. B.L.R.	..	1874	..	9·68	—	—
to.g.v.	**Couleuvrine** (1)	320	196	10	21	7	steel	5	11	2	1800	2 l., 3 M.	2 tu.	1885	..	18·00	—	—
„	**Dague** (1)	320	196	10	21	7	steel	5	11	2	1800	2 l., 3 M.	2 tu.	..	..	18·00	—	—
sl.	**Dayot**	1350	204	8	34	4	wood	15	10	1	917	1 14-c.m. B.L.R., 5 14-c.m. do., 2 M.	..	1869	..	11·76	—	—
cr.	**Decrès**	1800	244	3	38	8	wood	18	2	1	1478	1 16-c.m. B.L.R., 9 14-c.m. do.	..	1866	..	12·04	—	—
s.g.to.	**Dehorter**	70	131	0	10	10	steel	4	5	..	..	2 M.	..	..	..	22·00	—	—
„	**Déroulède**	70	131	0	10	10	steel	4	5	..	..	2 M.	..	..	..	22·00	—	—
cr.	**Desaix**	1700	259	2	34	8	wood	17	7	1	1442	4 10-c.m. B.L.R., 2 M.	..	1866	..	14·21	—	—
„	**D'Estaing**	2400	262	5	37	5	wood & iron	18	8	1	3700	15 14-c.m. B.L.R., 10 M.	..	1879	..	15·31	—	—
sl.	**D'Estrées**	1340	207	4	34	0	wood	15	9	1	1003	1 14-c.m. B.L.R., 5 14-c.m. do., 2 M.	..	1867	..	12·30	—	—
s.g.to.	**Doudart de Lagrée**	70	131	0	10	10	steel	4	5	..	..	2 M.	..	..	..	22·00	—	—
to.g.v.	**Dragonne** (1)	320	196	10	21	7	steel	5	11	2	1800	2 l., 3 M.	2 tu.	..	..	18·00	—	—
fr.c.	**Dubourdieu** (3)	3400	253	7	46	6	wood	22	10	1	3300	4 16-c.m. B.L.R. 22 14-c.m. B.L.R.,	tu.	1884	hull, 95,833; machinery, 30,720; equipment, 28,000.	14·00	—	—
sl.	**Duchaffaud**	1340	204	8	34	2	wood	16	0	1	1214	6 14-c.m. B.L.R., 2 M.	..	1872	..	12·72	—	—
„	**Ducouedic**	1340	204	8	34	2	wood	16	6	1	769	1 16-c.m. B.L.R., 5 14-c.m. do. 2 M.	..	1869	..	11·57	—	—
cr.	**Duguay Trouin**	3300	296	3	43	4	iron & wood	20	6	1	3740	5 19-c.m. B.L.R., 5 14-c.m. do.	..	1877	..	15·90	430	—
g.v.	**Dumont d'Urville**	860	201	11	28	6	wood	13	8	1	850	4 14 c.m. B.L.R.	..	1878	..	11·60	—	—
cr.	**Du Petit Thouars**	2000	257	10	35	9	wood	18	5	1	2018	10 14-c.m. B.L.R.	..	1874	..	15·07	—	—

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FRANCE.—Unarmoured Ships—*continued.*

cr., cruiser; *d.v.*, despatch vessel; *fr.c.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; *s.g.to.*, sea-going torpedo boat; *to.cr.*, torpedo cruiser; *to.g.v.*, torpedo gun-vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
cr.	Dupleix	1850	210 0	37 5	wood	18 0	1	1215	12 14-c.m. B.L.R.	..	1861	..	11·47	—	—
fr.c.	Duquesne	5800	333 5	50 3	iron & wood	25	1	6589	7 12-c.m. B.L.R., 14 14-c.m. do., 8 M.	..	1876	..	16·90	600	—
sl.	Éclaireur	1830	236 3	35 5	iron & wood	17 0	1	2050	8 14-c.m. B.L.R., 2 M.	..	1877	..	15·00	—	—
s.g.to.	Edmond Fontaine (1)	70	131 0	10 10	steel	4 5	..	..	2 M.	..	..	..	22·00	—	—
g.v.	Etendard	510	142 6	24 4	wood	9 5	2	232	1 19-c.m. B.L.R., 1 12-c.m. do.	..	1868	..	7·00	—	—
to.cr.	Epervier (1)	1280	216 6	29 3	steel	15 5	2	2000 & 3200 (forced draught)	5 10-c.m. B.L.R., 6 M.	5 tu.	1885	..	17·00	—	—
g.v.	Étoile	450	149 3	24 7	composite	8 4	2	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1885	—	—	—	—
cr.	Fabert	2100	249 4	38 0	wood	18 4	1	1107	8 14-c.m. B.L.R.	..	1874	..	12·42	—	—
g.v.	Fanfare	510	142 0	24 4	wood	9 5	2	233	1 19-c.m. B.L.R., 1 12-c.m. do.	..	1868	..	8·39	—	—
to.cr.	Faucon (1)	1280	216 6	29 3	steel	15 5	2	2000 & 3200 (forced draught)	5 10-c.m. B.L.R., 6 M.	5 tu.	1885	..	17·00	—	—
to.g.v.	Fleche (1)	320	196 10	21 7	steel	5 11	2	1800	2 l., 3 M.	2 tu.	..	..	18·00	—	—
fr.c.	Flore	3500	246 3	47 3	wood	22 10	1	1465	22 14-c.m. B.L.R., 3 10-c.m. do., 8 M.	..	1869	..	12·49	—	—
cr.	Forbin	1850	..	..	..	..	..	..	2 14-c.m. B.L.R.	..	Bldg.	..	19·50	—	—
cr.	Forfait	2400	249 4	38 0	wood & iron	18 0	1	2764	15 14-c.m. B.L.R., 2 l., 6 M.	..	1879	..	13·44	—	—
g.v.	Fulton	825	199 5	28 5	wood	12 8	1	850	4 14-c.m. B.L.R.	—	—	—	—	—	—
„	Gabes	490	151 6	24 9	„	10 6	1	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1884	..	?8·00	—	—
„	Gladiateur	490	142 0	24 4	„	9 5	2	218	1 14-c.m. B.L.R., 1 12-c.m. do., 2 M.	..	1868	..	8·39	—	—
d.v.	Guichen	750	183 6	28 0	„	12 0	1	593	1 16-c.m. B.L.R., 1 14-c.m. do.	..	1865	..	10·70	—	—
sl.	Hamelin	1340	207 7	34 2	„	15 10	1	1155	1 16-c.m. B.L.R., 5 14-c.m. B.L.R., 2 M.	..	1866	..	12·58	—	—

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d.v.	**Hirondelle**	1040	249	6	30	4	wood	12	8	2	1780	2 14-c.m. B.L.R.	..	1869	..	15·50	—	—
sl.	**Hugon**	1340	204	5	34	2	„	15	10	1	1054	1 16-c.m. B.L.R., 5 14-c.m. do., 2 M.	..	1872	..	11·72	—	—
d.v.	**Hussard**	880	201	10	28	6	„	13	7	1	850	4 14-c.m. B.L.R.	..	1877	..	12·08	—	—
g.v.	**Hyène**	470	142	0	24	5	„	9	5	2	258	1 14-c.m. B.L.R., 1 10-c.m. do.	..	1868	..	9·06	—	—
d.v.	**Inconstant**	825	199	5	28	5	„	12	7	1	850	4 14-c.m. B.L.R.	..	Bldg.	—	—	—	—
cr.	**Infernet**	1931	262	2	35	9	„	18	4	1	1815	1 16-c.m. B.L.R., 7 14-c.m. do.	..	1869	..	13·90	—	—
fr.c.	**Iphigénie**	3200	244	6	46	6	„	22	4	1	2800	2 16-c.m. B.L.R., 18 14-c.m. do., 3 l., 10 M.	..	1881	..	14·00	—	—
g.v.	**Jaguar**	460	142	0	24	5	„	9	5	2	270	1 14-c.m. B.L.R., 1 12-c.m. do., 2 M.	..	1868	..	9·37	—	—
sl.	**Kerguelen**	1340	204	5	34	2	„	15	10	1	1200	6 14-c.m. B.L.R., 2 M.	..	1872	..	12·76	—	—
d.v.	**Labourdonnais**	860	199	5	28	5	„	12	7	1	787	4 14-c.m. B.L.R.	..	1875	..	11·69	—	—
cr.	**Laclocheterie**	2000	262	2	35	9	„	18	4	1	1918	10 14-c.m. B.L.R., 2 l.	..	1872	..	13·73	300	—
to.g.v.	**Lance** (1)	320	196	10	21	7	steel	5	11	2	1800	2 l., 3 M.	2 tu.	..	..	18·00	—	—
cr.	**Lapérouse**	2400	262	5	37	5	wood & iron	18	8	1	2280	15 14-c.m. B.L.R., 2 l., 6 M.	..	1877	..	14·73	—	—
d.v.	**Latouche Treville**	603	173	10	28	7	„	12	0	1	552	2 14-c.m. B.L.R., 2 12-c.m. do.	..	1860	..	10·43	—	—
g.v.	**Léopard**	445	142	0	24	5	„	9	5	2	277	1 14-c.m. B.L.R., 1 12-c.m. do., 2 M.	..	1868	..	9·60	—	—
sl.	**Limier**	1330	207	4	34	0	„	15	10	1	1084	6 14-c.m. B.L.R., 2 M.	..	1866	..	11·80	—	—
„	**Linois**	1210	203	5	32	2	„	15	2	1	720	6 14-c.m. B.L.R., 2 M.	..	1867	..	11·50	—	—
g.v.	**Lion**	470	151	6	24	9	composite	10	6	1	400	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1884	..	8·00	—	—
„	**Lionne**	500	141	9	23	11	„	9	6	1	426	1 14-c.m. B.L.R., 2 l., 2 M.	..	1877	..	9·81	—	—
„	**Lutin**	490	141	9	23	11	„	9	4	1	427	2 14-c.m. B.L.R., 2 l.	..	1877	..	10·00	—	—
„	**Lynx**	485	141	9	23	11	„	9	4	1	427	2 14-c.m. B.L.R., 2 l.	..	1878	..	10·38	—	—
fr.c.	**Magicienne**	3400	246	0	47	3	wood	22	10	1	1402	28 16-c.m. B.L.R.	..	1861	..	10·28	—	—
cr.	**Magon**	2300	249	4	38	0	wood & iron	18	0	1	2462	15 14-c.m. B.L.R., 2 l., 6 M.	..	1880	..	14·17	—	—
g.v.	**Météore**	470	151	6	24	9	composite	10	6	1	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1884	..	10·00	—	—
sl.	**Milan**	1540	303	2	32	10	steel	14	7	2	4132	5 10-c.m. B.L.R., 8 M.	2 tu.	1884	..	18·00	—	—
fr.c.	**Minerve**	2800	246	9	42	8	wood	21	4	1	1601	14 14-c.m. B.L.R.	..	1865	..	10·91	—	—
„	**Naiade**	3500	246	0	47	2	wood & iron	22	10	1	3260	4 16-c.m. B.L.R., 18 14-c.m. do., 4 M.	4 tu.	1881	..	13·68	—	—
cr.	**Nielly**	2300	262	5	37	5	„	18	8	1	2921	15 14-c.m. B.L.R., 10 M.	..	1880	..	15·23	—	—
d.v.	**Papin**	825	201	10	28	6	wood	13	7	1	850	4 14-c.m. B.L.R.	—	Bldg.	—	—	—	—
d.v.	**Parseval**	790	197	6	28	0	wood	12	2	1	817	4 14-c.m. B.L.R.	..	1879	..	12·33	—	—
g.v.	**Pique**	405	127	6	22	0	wood	8	10	2	205	2 5½-c.m. 3 ton B.L.R.	—	—	—	9·25	—	—
cr.	**Primauguet**	2100	262	5	37	5	wood & iron	18	8	1	2268	15 14-c.m. B.L.R., 10 M.	..	1882	..	15·00	—	—

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FRANCE.—Unarmoured Ships—*continued.*

cr., cruiser; *d.v.*, despatch vessel; *fr.c.*, frigate-built cruiser; *g.v.*, gun vessel; *sl.*, sloop; *s.g.to.*, sea-going torpedo boat; *to.cr.*, torpedo cruiser; *to.g.v.*, torpedo gun-vessel; P, deck protected throughout.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at ten knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
cr.	**Rapide**	1900	—	—	—	—	—	—	—	—	—	—	—	—	—
sl.	**Rigault de Genouilly**	1710	236 3	35 5	„	17 0	1	2050	8 14-c.m. B.L.R., 2 M.	..	1876	..	14·49	—	—
cr.	**Roland**	2300	249 4	38 0	„	17 7	1	2700	15 14-c.m. B.L.R., 6 M.	..	1882	—	14·50	—	—
g.v.	**Sagittaire**	490	148 4	23 10	„	10 5	1	427	2 14-c.m. B.L.R., 2 10-c.m. do.	..	1881	..	11·05	—	—
to.g.v.	**Sainte Barbe** (1)	320	196 10	21 7	steel	5 11	2	1800	2 l., 3 M.	2 tu	..	..	18·00	—	—
„	**Salve** (1)	320	196 10	21 7	„	5 11	2	1800	2 l., 3 M.	2 tu.	..	..	18·00	—	—
cr.	**Sané**	1900	249 4	38 0	wood	18 4	1	1998	6 14-c.m. B.L.R.	..	1870	..	15·02	—	—
g.v.	**Scorpion**	470	151 6	24 9	composite	10 6	1	450	2 14-c.m. B.L.R.. 2 10-c.m. do.	..	1883	—	—	—	—
sl.	**Segond**	1280	204 8	34 2	wood	15 10	1	894	6 14-c.m. B.L.R., 2 M.	..	1869	..	11·26	—	—
c.r.	**Seignelay**	1900	249 4	38 0	„	18 4	1	1967	8 14-c.m. B.L.R.	..	1874	..	15·00	—	—
fr.c.	**Sfax** (1) P.	4488	288 9	49 3	steel & wood	24 9	2	5000	6 16-c.m. B.L.R., 10 14-c.m. do., 8 M.	..	1884	200,000	16·00	6200	—
g.v.	**Sirius**	473	142 0	24 9	wood	10 6	1	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	—	—	—	—	—	—
cr.	**Surconf**	1850	..	..	..	..	..	..	2 14-c.m. B.L.R.	..	Bldg.	..	19·50	—	—
to.cr.	**Tage** P.	7045	390 0	52 5	steel	..	..	10,330	6 16-c.m. B.L.R., 10 14-c.m. do., 15 M.	7 tu.	Bldg.	..	19·00	—	—
g.v.	**Tactique**	400	427 6	24 9	wood	8 4	1	175	2 4½-c.m. B.L.R.	—	—	—	7·2	—	—
sl.	**Talisman**	1410	224 9	33 6	steel	15 5	1	691	4 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1862	..	11·28	—	—
fr.c.	**Tourville**	5600	333 5	50 3	iron & wood	25 4	1	7466	7 19-c.m. B.L.R., 14 14-c.m. do.	..	1876	..	16·89	800	—
sl.	**Vandreuil**	1280	204 8	34 1	wood	15 10	1	867	1 16-c.m. B.L.R., 4 14-c.m. B.L.R., 2 M.	..	1870	..	11·28	—	—
to.cr.	**Vautour** (1).	1280	216 6	29 3	steel	15 5	2	2000 & 3200 (forced draught)	5 10-c.m. B.L.R., 6 M.	5 tu.	..	..	17·00	—	—

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fr.c.	**Vénus**	2800	246	9	42	8	wood	21	4	1	1308	16 14-c.m. B.L.R., 6 M.	1864	..	12·57	—	—
cr.	**Villars**	2400	249	4	38	0	wood & iron	17	7	1	2380	15 14-c.m. B.L.R., 6 M.	1879	..	14·25	—	—
g.v.	**Vipère**	490	145	4	23	10	composite	10	6	1	427	2 14-c.m. B.L.R., 2 10-c.m. do. . ..	1881	..	10·30	—	—
d.v.	**Volage**	510	160	5	28	3	wood	11	9	1	401	2 9-c.m. B.L.R., 4 M.	1881	..	10·76	—	—
sl.	**Volta**	1350	207	8	33	9	„	15	7	1	1066	6 14-c.m. B.L.R., 2 M.	1867	..	12·94	—	—
d.v.	**Voltigeur**	910	199	5	28	5	wood & iron	12	7	1	850	4 14-c.m. B.L.R.	1878	..	12·48	—	—

Besides transports, of which there is a large number, store ships, surveying vessels, training ships, yachts, sailing vessels, &c., there are, on the List of the French Navy, the following:—

River and local (*screw*) *despatch vessels* (*Avisos de flotille*).—Actif, Carpe, Chimère, Cuvier, Élan, Ibis, Loyalty, Marabout, Mirmidon, Mouette, Pygmée, Rubis, Turquoise. 165 to 254 tons; 205 to 417 I.H.P.

River and local (*paddle*) *despatch vessels* (*Avisos de flotille*).—Albatros, Ardent, Alcyon, Alouette, Basilic, Brandon, Castor, Cigale, Écureuil, Estafette, Goëland, Gogah, Héron, Jouffroy, Laprade, Magicien, Mesange, Nagotna, Oyap-ock, Pétrel, Phoque, Pingouin, Pluvier, Salamandre, Vigilant.

Gunboats (*Canonnières de flotille*).—Surprise, Tactique. 400 tons; 173 to 206 I.H.P.

River (*screw*) *gunboats* (*Chaloupes canonnières*).—Alerte, Arbalète, Arquebuse, Avalanche, Bäionette, Bouclier, Bourrasque, Carabine, Caronade Casse-tête Cimetere, Coutelas, Épée, Épieu, Escopette, Estoc, Flamberge, Framée, Glaive, Hache, Harpon, Javeline, Javelot, Massue, Mitrailleuse, Mousqueton, Mutine, Perrier, Rafale, Redoute, Revolver, Sagaie, Tirailleuse, Tromblon, Yatagan.

River (*paddle*) *gunboats* (*Chaloupes canonnières*). — Berthe-de-Villers, Biche, Carreau, Chamois, Éclair, Garnier, Henry-Rivière, Jacquin, Moulun, Pionnier, Trombe.

In addition to the sea-going torpedo-boats in the Tables, there are—9 first class torpedo-boats of 133 feet in length building; 51 of 114 feet in length building, and 18 of 108 feet in length completed. Boats of the second class under 100 feet in length, 41 completed; and under 70 feet in length, 9 completed. One torpedo depôt-ship —the Japon—of 3970 tons displacement and 1500 I.H.P.

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NOTES ON THE FRENCH NAVY.—UNARMOURED SHIPS.

Torpedo Vessels.

(1) In the new classification now adopted in the French Navy torpedo craft are divided into several classes:—1. Torpedo cruisers (*croiseurs-torpilleurs*), with a displacement of 1240 to 1280 tons. 2. Torpedo gun-vessels (*avisos-torpilleurs*), with a displacement of 320 to 380 tons. 3. Sea-going torpedo boats (*torpilleurs de haute mer*), with a displacement of 50 tons and upwards. 4. Torpedo boats for coast service (*torpilleurs-garde-côtes*), forming two classes, the first of 25 tons, the second of 50 tons. 5. Torpedo boat look-outs (*torpilleurs-vedettes*), with a displacement of less than 25 tons.

The vessels of the Bombe class are built of steel and are designed so that the hull may be as light as possible, yet sufficiently strong for navigating the high seas. They have two screws driven by separate engines. They have three masts with fore and aft rig and "leg of mutton" sails. The rigging is of steel wire.

Condor.

Condor.

The Condor is built of steel, of light construction, with fine and graceful lines. She is at the same time a look-out vessel of great speed, and a torpedo-boat catcher. She is armed with fish-torpedoes and guns of small calibre. There are four cylindrical boilers. The hull is divided into ten principal water-tight compartments, the bulkheads coming up to the armoured deck; there are, besides, longitudinal bulkheads. A steel "turtle-back" deck sloping to the sides and ends of the vessel runs through her whole length, about on a level with the water-line, as a necessary protection against plunging fire from light guns. The Condor has only small masts for signalling purposes, and to provide firing places for machine guns. She has five torpedo launching tubes—two forward, one astern, and one on each beam; also five steel 10-c.m. guns and six Hotchkiss machine guns. The Condor's engines were made in England.

Cécille.

The Cécille.

(2) The Cécille's hull is of iron and steel, and is divided into 15 compartments by water-tight bulkheads extending from the armoured deck to the edge of the side plating. The armoured deck runs the whole length of the ship and protects the engines, boilers, steering

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gear, &c. A deck to give shelter from fragments of shells, and a cellular deck are placed, the one above, and the other below the armoured deck. Above the cellular deck, running right round the ship, there is a coffer-dam to be filled with cellulose. There are two separate sets of machinery, one for each screw, three independent pairs of cylindrical boilers, and three auxiliary boilers. The armament will include six 16-c.m. guns on the upper deck, ten 14-c.m. guns on the main deck, ten 37-mm. Hotchkiss machine-guns on deck and in the tops, three Hotchkiss quick-firers, and four torpedo launching tubes. The ship will have three square-rigged masts. The Cécille is to be finished by the middle of 1888, and is to steam 19 knots.

Dubourdieu.

The Dubourdieu.

(3) The Dubourdieu's four 16-c.m. guns are mounted *en barbette*, so that two can be fired right ahead, and two right astern. She has torpedo launching-stations on deck.

Sfax.

The Sfax.

(4) The Sfax is built of steel. The hull is cased with wood and the bottom is sheathed with copper. Below the water-line the Sfax has a water-tight deck armoured with 1·5-in. steel plating, which protects the vital parts, engines, boilers, magazines, &c. Between this deck and the main deck there is the cellular portion, which encloses the coal-bunkers, &c., and which takes the place of a water-line armour belt. It is divided by 7 longitudinal, and 16 'thwart-ship principal bulkheads. The compartments not used for coal or stores serve as coffer-dams, and are filled with cellulose.

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GERMANY.—Armoured Ships.

(Except where specially stated otherwise, all the following have hulls of iron.)
a.g.b., armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.b.* central-battery ship; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propellers.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt or Citadel.	Battery or Breastwork.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	ins.	ft. in.						£	knots.	tons.	knots.
br.	**Arminius**	1583	197 4	36 0	4½	7½ turret	9	13 10	1	1200	4 21-c.m. B.L.R.	..	1864	92,512	10·50	—	—
b.	**Baden**	7400	298 0	60 0	16	10 on barbette	8	19 8	2	5600	6 26-c.m. B.L.R., 4 l., 6 M.	..	1880	444,886	14·00	—	—
a.g.b.	**Basilisk**	1109	143 0	35 6	8	8 turret	8	10 2	2	700	1 30½-c.m. B.L R., 2 M.	..	1878	58,042	9·00	—	—
b.	**Bayern**	7400	298 0	60 0	16	10 barbette	8	19 8	2	5600	6 26-c.m. B.L.R., 4 l., 6 M.	..	1878	406,660	14·00	—	—
a.g.b.	**Biene** (1)	1109	143 0	35 6	8	8 turret	8	10 2	2	700	1 30½-c.m. B.L.R., 2 M.	..	1876	62,853	9·00	—	—
a.g.b.	**Camäleon**	1109	143 0	35 6	8	8 turret	8	10 2	2	700	1 30½-c.m. B.L.R., 2 M.	..	1878	57,564	9·00	—	—
„	**Crocodil**	1109	143 0	35 6	8	8 turret	8	10 2	2	700	1 30½-c.m. B.L.R., 2 M.	..	1879	57,237	9·00	—	—
c.b.	**Deutschland**	7676	280 0	62 4	10	8	10	24 7	1	8000	8 26-c.m. B.L.R., 1 21-c.m. do., 6 15-c.m. do., 4 l., 6 M.	..	1874	412,022	14·5	710	3400
„	**Friedrich Carl**	6007	300 0	54 6	5	4½	15	23 11	1	3500	1 21-c.m. B.L.R., 15 21-c.m. do., 4 l., 6 M.	..	1867	322,663	13·60	672	1550
t.	**Friedrich der Grosse**	6770	307 0	53 6	9½+1⅛	8⅛ breastwork, 10½ turret	8½	24 7	1	4930	4 26-c.m. B.L.R, 2 17-c.m. do., 4 l., 6 M.	..	1874	365,170	14·00	..	2500
c.b.	(*Hansa*) (wood)	3610	235 2	45 0	6	6 & 4½	12½	21 8	1	2142	8 21-c.m. B.L.R., 4 l., 6 M.	..	1872	183,270	12·00	—	—
a.g.b.	**Hummel**	1109	143 0	35 6	8	8 turret	8	10 2	1	750	1 30-c.m. B.L.R., 2 M.	..	1881	56,741	9·00	—	—
c.b.	**Kaiser**	7676	280 0	62 4	10	8	10	24 7	1	7803	8 26-c.m. B.L.R., 1 21-c.m. do., 6 15-c.m. do., 4 l., 6 M.	..	1874	411,301	14·60	710	3400
br.	**König Wilhelm**	9567	355 0	60 0	8	7	10	26 7	1	8350	18 24-c.m. B.L.R., 5 21-c.m. do., 6 15-c.m. do., 4 l., 6 M.	..	1868	505,141	14·70	700	1740
c.b.	**Kronprins**	5568	286 0	50 0	5	4½	16	24 3	1	4800	1 21-c.m. B.L.R., 15 21-c.m. do., 4 l., 6 M.	..	1867	314,836	14·30	—	—

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a.g.b.	**Mücke** . . .		1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. B.L.R., 2 M.		1877	60,960	9·00	—	—
„	**Natter** . . .		1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. B.L.R., 2 M.		1880	52,822	9·00	—	—
b.	**Oldenburg** (2)	(steel)	5200	246	0	59	0	13 (compound)	..	..	..	2	3900	8 24-c.m. B.L.R., 4 15-c.m. do., 2 l., 6 M.		4 tu.	1884	?235,342	13.5	—	—
t.	**Preussen** . . .		6770	308	6	53	6	9	8 breast-work 10 turret	8	24	7	1	4383	4 26-c.m. B.L.R., 2 17-c.m. do., 4 l., 6 M.		..	1873	351,904	14·00	..	2500
b.	**Sachsen** . . .		7400	298	0	60	0	16	10 barbette	8	19	8	2	5600	6 26-c.m. B.L.R., 4 l., 6 M. . . .		..	1877	422,178	14·00	—	—
a.g.b.	**Salamander** . . .		1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. B.L.R., 2 M.			1880	56,914	9·00	—	—
„	**Scorpion** . . .		1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. B.L.R., 2 M.			1877	60,796	9·00	—	—
„	**Viper** . . .		1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. B.L.R., 2 M.			1876	61,463	9·00	30	400 at 9 knots
„	**Wespe** . . .		1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. B.L.R., 2 M.			1876	53,771	9·0	..	360 at 9 knots
b.	**Wurttemberg** . .		7400	298	0	60	0	16	10 barbette	8	19	8	2	5600	6 26-c.m. B.L.R., 4 l., 6 M. . . .		..	1878	402,512	14·00	—	—

(1) On the 4th June, 1884, the armoured gunboats Biene, Krokodil, Hummel, and Camäleon were passing through the channel between the island of Rugen and the coast of Pomerania, with a strong westerly wind causing the vessels to pitch heavily, when the Biene struck on a sunken rock and began to fill. Though the order to close the compartments was quickly given, three were filled, and the vessel had to be run ashore to prevent total loss. The Biene was afterwards pumped out and towed to Kiel for repairs.

(2) The Oldenburg was originally intended to be the last of the Sachsen class. As completed she differs from it considerably, and is much smaller. She is to be employed principally for service in the Baltic. She has two compound engines of four cylinders each. The "casemate" is plated with compound armour, and contains six 24-c.m. (9·4 inch) guns, three on each side. Two guns of the same calibre are mounted on the Fore-castle, and four 15-c.m. (5·9 inch) guns abaft. There are one torpedo-launching-tube forward and three aft, below the water-line.

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GERMANY.—Unarmoured Ships.

corv., corvette; *d.v.*, despatch vessel; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *to.r.*, torpedo ram; P., deck protected throughout.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-Power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at ten knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
g.v.	**Adler**	884	177 2	33 10	composite	11 6	1	724	2 15-c.m. B.L.R., 2 12-c.m. do.	..	1883	44,047	11·00	—	—
„	**Albatross**	716	168 0	26 10	wood	10 6	1	496	2 15-c.m. B.L.R., 2 12-c.m. do.	..	1871	38,092	10·00	—	—
corv.	**Alexandrine** (1)	2373	236 3	42 7	iron, steel, and wood sheathed	18 4	1	2400	12 15-c.m. B.L.R., 2 8·7-c.m. do., 1 l., 4 M.	1 tu.	1885	102,877	15·00	—	—
„	**Arcona**	2373	236 3	42 7	„	18 4	1	2400	12 15-c.m. B.L.R., 2 8·7-c.m. do., 1 l., 4 M.	1 tu.	1885	109,875	15·00	—	—
„	**Ariadne**	1727	204 0	35 0	wood	17 4	1	2100	6 15-c.m. B.L.R., 2 12-c.m. do., 1 l., 4 M.	..	1871	91,979	13·00	—	—
fr. cr.	**To replace Ariadne** P.	4800	..	..	steel	..	2	..	.. .. ..	..	Bldg.	..	18·00	—	—
fr. cr.	**Bismarck**	2856	244 4	44 10	iron and wood	19 8	1	2529	16 15-c.m. B.L.R., 2 l., 6 M.	tu.	1877	136,055	13·00	—	—
d.v.	**Blitz**	1382	246 0	32 10	steel	13 5	1	2839	1 12½-c.m. B.L.R., 4 8·7-c.m. do., 4 M.	..	1882	66,935	16·00	—	—
fr.cr.	**Blucher***	2856	244 4	44 10	iron & wood	19 8	1	2990	16 15-c.m. B.L.R., 2 l., 6 M.	6 tu.	1877	136,408	14·00	—	—
to.r.	**Bremse** (2) P.	866	203 5	27 10	steel	10 6	..	1500	1 21-c.m. B.L.R.	..	1884	?49,308	15·00	—	—
„	**Brummer** (2) P.	866	203 5	27 1	steel	10 6	..	1500	1 21-c.m. B.L.R.	..	1884	?52,422	15·00	—	—
corv.	**Carola**	2169	226 4	42 7	„	18 4	1	2340	8 15-c.m. B.L.R., 2 8·7-c.m. do., 1 l., 4 M.	..	1880	109,617	14·00	—	?2000
fr.cr.	**Charlotte**	3360	..	..	„	..	1	3000	18 15-c.m. B.L.R., 2 l., 6 M.	tu.	1885	..	16·00	—	—
g.v.	**Cyclop**	412	125 0	23 0	iron	8 2	1	250	2 12-c.m. B.L.R., 2 8-c.m. do.	..	1874	16,980	8·0	—	—
fr.cr.	**Elisabeth**	2508	216 10	41 7	wood	19 1	1	2400	19 15-c.m. B.L.R., 2 l., 6 M.	..	1868	103,313	12·00	—	—
fr. cr.	**To replace Elisabeth** P.	4250	308 0	46 0	steel and wood	21 0	2	8000	14 6 in. B.L.B. Krupp	..	Bldg.	..	18·00	800	—
corv.	**Freya**	2017	259 2	35 0	„	17 4	1	2471	8 15-c.m. B.L.R., 1 l., 4 M.	..	1875	106,868	15·00	—	—
fr.cr.	**Gneisenau**	2856	244 4	44 10	iron and wood	19 8	1	2500	16 15-c.m. B.L.R., 2 l. 6 M.	tu.	1879	154,445	13·00	—	—
g.v.	**Habicht**	848	174 0	29 6	composite	11 5	1	875	1 15-c.m. B.L.R., 4 12-c.m. do., 4 8·7-c.m. do.	..	1879	33,054	12·00	—	—
„	**Hyäne**	489	139 8	25 1	iron	9 10	1	340	2 11½-c.m. B.L.R., 2 l.	..	1878	24,340	9·00	—	—
„	**Iltis**	489	139 8	25 1	„	9 10	1	380	2 11½-c.m. B.L.R., 2 l.	..	1878	27,480	9·00	—	—
fr.cr.	**Leipzig**	3925	282 2	42 8	iron and wood	21 7	1	3590	12 17-c.m. B.L.R., 2 l., 6 M.	..	1875	203,055	14·00	—	4000
corv.	**Luise**	1719	204 0	35 0	wood	17 4	1	2100	6 15-c.m. B.L.R., 2 12-c.m. do., 1 l., 4 M.	..	1872	85,975	13·00	—	—
„	**Marie**	2169	226 4	42 7	iron & wood	18 4	1	2257	8 15-c.m., B.L.R., 2 8·7-c.m. do., 1 l., 4 M.	..	1881	..	13·00	—	2000
fr.cr.	**Moltke**	2856	244 4	44 10	„	19 8	1	2500	16 15-c.m. B.L.R., 2 l., 6 M.	tu.	1877	140,705	13·00	—	—
g.v.	**Möwe**	848	174 0	29 6	composite	11 5	1	784	1 15-c.m. B.L.R., 4 12-c.m. do., 4 8·7-c.m. do.	..	1879	33,390	12·00	—	—

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„	**Nautilus**	716	168	0	26	10	wood	10	6	1	496	2 15-c.m. B.L.R., 2 12-c.m. do.	..	1871	38,147	10·00	—	—
corv.	**Olga**	2169	226	4	42	7	iron & wood	18	4	1	2397	8 15-c.m. B.L.R., 2 8·7-c.m. do., 1 l., 4 M.	..	1880	113,812	14·00	—	? 2000
d.v.	**Pfeil**	1382	246	0	32	10	steel	13	5	1	2700	1 12½-c.m. B.L.R., 4 8·7-c.m. do., 4 M.	..	1882	73,605 (estimated)	15·00	—	—
														1876	206,499	15·00	—	—
fr.cr.	**Prinz Adalbert**	3925	282	2	42	8	iron & wood	21	7	1	3612	12 17-c.m. B.L.R., 2 l., 6 M.	..	1881	117,155	14·00	—	? 2000
corv.	**Sophie**	2169	226	4	42	7	„	18	4	1	2100	8 15-c.m. B.L.R., 2 87-c.m. do., 1 l., 4 M.	..	1879	136,069	14·00	—	—
fr.cr.	**Stein**	2856	244	4	44	10	„	19	8	1	2707	16 15-c.m. B.L.R., 2 l., 6 M.	tu.	1877	126,066	13·00	—	—
„	**Stosch**	2856	244	4	44	10	„	19	8	1	2581	16 15-c.m. B.L.R., 2 l., 6 M.	tu.	1864	84,450	13·00	—	—
corv.	**Victoria**	1825	235	9	35	4	wood	17	8	1	1300	4 15-c.m. B.L.R., 6 12-c.m. do., 1 l., 4 M.	..	1878	24,343	9·00	—	—
g.v.	**Wolf**	489	139	8	25	1	iron	9	10	1	340	2 11½-c.m. B.L.R., 2 l.	..	1876	81,755	16·00	—	—
d.v.	**Zieten**	975	196	10	29	6	„	11	6	1	2323	4 12-c.m. B.L.R., 4 M.	..					

* The Blucher is used as a torpedo school.

Two corvettes of 1400 tons displacement are being built; also a cruiser of 900 tons to replace Albatross and one Torpedo gunboat.

In addition to the ships whose names are given in the Tables, one large cruiser to replace the Elisabeth and one gun vessel to replace the Albatross are about to be built. There are, also, on the German list, besides stationary, surveying, harbour vessels and yachts, the following:—

One steam gunnery ship.
Two steam gunnery tenders
One steam torpedo tender (Ulan).
One steam gunboat (Dracke).
Two steam training ships.
Eight small torpedo vessels; 50 to 140 tons, 500 to 550 I.H.P.

Torpedo Boats.—58 completed of the first class (of which 43 are over 100 feet in length)

Building 2 torpedo division boats to cost £29,000 each, and 30 boats over 100 feet in length.

Money was voted in 1884–5 for 70 torpedo boats. When these boats are completed the total number of torpedo boats will be 105, which number is to be increased eventually to 150.

(1) The Alexandrine is constructed of iron and steel throughout, her iron skin having a double teak planking, sheathed with copper. Cross bulkheads divide the vessel into eight water-tight compartments. Steam is supplied to each of the two engines by four cylindrical boilers in two separate boiler-rooms. Her screw can be lifted for sailing.

(2) The Bremse and Brummer are torpedo-rams, with a steeply-arched armour-deck, 5½ feet under water at the sides and 10 inches above the water-line at the crown. In the space between the armour-deck and the principal deck are many water-tight compartments. The hatchways are armoured.

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HAYTI.

(The Republic of Hayti has unarmoured ships only.)
corv., corvette; *g.v.*, gun-vessel; *sl.*, sloop.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean draught of water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	
g.v.	**22nd December** .	900	208 0	29 11	iron	16 0	1	360	4 40-pdr. (Armstrong)	..	1860	..	9·00	..	..
corv.	**Dessalines** . .	..	185 0	32 0	„	14 9	..	..	1 7-in., 2 30-pdr., 4 34-pdr. . . .	..	1883	..	16·00	..	..
sl.	**St. Michael** . .	850	162 0	33 0	„	11 0	1	120 (nominal)	1 11-in. smoothbore, 8 30-pdr. . .	..	1875	..	12·00	..	..
„	**1804** . . .	600	145 0	29 0	„	10 0	1	100 (nominal)	1 10-in. smoothbore, 6 30-pdr. . .	..	1875	..	12·00	..	..
„	**Troussaint Louverture**	..	164 0	24 6	steel	9 6	..	800	1 6½-in. B.L.R., 2 4¾-in. do.	..	bldng.	..	12·0	..	..

GREECE.—Armoured Ships.

br., broadside ship; *c.b.*, central-battery ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Mean Draught of Water.	Propeller.	Indicated Horse power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery.					Guns.	Tor-pedoes					
		tons.	ft. in.	ft. in.	inches.	inches.	ins.	ft. in.						£	knots.	tons.	
c.b.	**King George** .	1774	200 2	32 10	7	6	..	15 6	2	2400	2 21-c.m. B.L.R. (Krupp), 4 1., 2 M. . .	..	1867	..	12·00	—	—
br.	(*Olga*) . (wood)	2060	230 0	59 0	4¾	4	..	18 0	1	1950	4 17-c.m. B.L.R. (long Krupp), 2 17-c.m. do.	..	1869	..	10·00	—	—

GREECE.—Unarmoured Ships.

corv., corvette; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Torpedoes.	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	
g.v.	**Acheloos**	420	131 3	24 11	steel	14 6	1	400	2 9·6-c.m. B.L.R. (Krupp), 3 M.	..	1884	..	10·00	—	—
corv.	**Admiral Miaulis**	1800	246 0	36 0	iron and wood	14 5	1	2200	3 17-c.m. B.L.R. (long Krupp), 1 17-c.m. do. (short), 4 1., 2 M.	..	1879	..	15·00	—	—
g.v.	**Alpheos**	420	131 3	24 11	steel	14 6	1	400	2 9·6-c.m. B.L.R. (Krupp), 3 M.	..	1884	..	10·00	—	—
„	**Aphroessa**	380	124 7	22 11	iron	8 10	1	160	1 8·7-c.m. B.L.R. (Krupp)	..	..	..	9·00	—	—
„	**Eurotas**	420	131 3	24 11	steel	14 6	1	400	2 9·6-c.m. B.L.R. (Krupp), 3 M.	..	1884	..	10·55	—	—
fr.cr.	**Hellas**	1300	200 2	37 0	wood	19 4	1	1500	12 15-c.m. B.L.R. (Krupp), 2 M.	..	1878 (repaired)	..	11·00	—	—
g.v.	**Hydra**	440	124 8	29 6	steel	9 6	2	380	1 26-c.m. B.L.R. (Krupp), 2 M.	..	1881	..	10.00	—	—
cr.	**Mecali** (was Buzzard)	1000	210 6	32 6	steel	..	2	1000	.. ..	..	1884	—	—	—	—
g.v.	**Nauplion**	380	124 7	22 11	iron	8 10	1	160	1 8·7-c.m. B.L.R. (Krupp)	..	..	..	9·00	—	—
„	**Paralos**	380	123 0	23 11	wood	8 10	1	204	1 8·7-c.m. B.L.R. (Krupp), 1 M.	..	1858	..	8·00	—	—
„	**Peneus**	420	131 3	24 11	steel	14 6	1	400	2 9·6-c.m. B.L.R. (Krupp), 3 M.	..	1884	..	10·55	—	—
„	**Plixiavra**	380	124 7	22 11	iron	8 10	1	160	1 8·7-c.m. B.L.R. (Krupp)	..	..	..	9·00	—	—
cr.	**Salamina**	380	123 0	23 11	wood	8 10	1	200	1 8·7-c.m. B.L.R. (Krupp), 1 M.	..	1858	..	8·00	—	—
„	**Sfaktirea** (was Eldorado)	1100	235 0	30 0	steel	..	1	950	.. ..	..	1885	..	..	—	—
g.v.	**Spetzais**	440	124 8	29 6	steel	9 6	2	380	1 26-c.m. B.L.R. (Krupp), 2 M.	..	1885	..	11·30	—	—
„	**Syros**	380	124 7	22 11	iron	8 10	1	160	1 8·7-c.m. B.L.R. (Krupp)	..	..	..	9·00	—	—

Torpedo depôt ship.—Psara, 1100 tons, 500 I.H.P., 2 10-c.m. B.L.R. (Krupp) guns, 2 Whitehead torpedo-launching guns, one port on each broadside, 2 under-water torpedo tubes ahead. 14 knots speed.

Torpedo boats.—27 of several classes, 6 being sea-going, of 128 ft. long, and 11 other first class boats of over 100 feet in length. Twenty small steamboats for torpedo purposes.

There are also four small iron steamers fitted for spar torpedoes; and five small composite custom-house steamers.

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ITALY.—Armoured Ships.

a.g.b., armoured gunboat; *b.*, barbette ship; *c.b.*, central-battery ship; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Citadel or Turret.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	ins.	ft. in.						£	knots.	tons.	knots.
t.	**Affondatore** . . .	4376	290 0	40 0	5	5 turret	9	20 0	1	3240	2 25-c.m. B.L.R. (Armstrong), 4 l., 6 M.	..	1865	152,480	13·00	460	1647
c.b.	**Ancona**	4250	256 0	50 0	4½	4½	13¾	21 11	1	2548	2 22-c.m. M.L.R. (Armstrong), 9 20-c.m. do., 6 l., 6 M.	..	1864	172,000	13·00	485	2000
b.	**Andrea Doria** (1) (steel)	11,000	328 2	65 4	..	17¾ comp.	..	27 2 (mean)	2	10,000	4 43-c.m. (110 ton) B.L.R. (Armstrong), 12 15-c.m. do., 6 l., 14 M.	3 tu.	1885	..	16·00	850	4500 at half speed
c.b.	**Castelfidardo** . . .	4250	256 0	50 0	4½	4½	13¾	21 11	1	2125	2 22-c.m. M.L.R. (Armstrong), 9 20-c.m. do., 6 l., 6 M.	..	1863	..	12·00	485	2600
t.	**Dandolo**	10,434	340 11	64 9	21½	18 turret	22¾	26 7	2	7500	4 45-c.m. (100 ton) M.L.R. (Armstrong), 6 l., 12 M.	tu.	1878	700,000	15·00	1279	3760
„	**Duilio**	10,570	340 11	64 9	21½	18 turret	22¾	26 7	2	7500	4 45-c.m. (100 ton) M.L.R. (Armstrong), 6 l., 12 M.	tu.	1876	..	15.00	1279	3760
c.b.	**Formidabile** . . .	2725	216 0	45 10	4½	..	9	18 0	1	1100	8 20-c.m. M.L.R. (Armstrong), 6l., 4 M.	..	1861	118,000	7·00	—	—
b.	**Francesco Morosini** (1) .	11,000	328 2	65 4	..	17¾ comp.	..	27 2 (mean)	2	10,000	4 43-c.m. (110 ton) B.L.R. (Armstrong), 12 15-c.m. do., 6 l., 14 M.	3 tu.	1885	..	16·00	850	4500 at half speed
„	**Italia** (2)	13,851	400 6	72 9	..	19 comp.	22¾	31 2	2	18,000	4 43-c.m. (110 ton) B.L.R. (Armstrong), 8 15-c.m. do., 6 l., 14 M.	4 tu.	1880	..	18·00	1650	8900
„	**Lepanto** (2) . . .	13,851	400 6	72 9	19 comp.	19 comp.	22¾	31 2	2	18,000	4 43-c.m. (110 ton) B.L.R. (Armstrong), 10 15-c.m. do., 6 l., 12 M.	4 tu.	1882	..	18·00	1650	8900
c.b.	**Maria Pia** . . .	4268	256 0	49 4	4½	4¼	13¾	22 7	1	2924	2 22-c.m. M.L.R. (Armstrong), 9 20-c.m. do., 6 l., 6 M.	..	1863	..	12·00	485	2600
2 batteries	(*Palestro*) . . (wood)	6419	265 0	57 10	8¾	6	24	26 11	1	3496	1 28-c.m. M.L.R. (Armstrong), 6 25-c.m. do., 6 l., 6 M.	..	1871	..	13·00	513	1780
„	(*Principe Amedeo*) (wood)	5814	265 0	55 9	8¾	6	24	26 6	1	3413	1 28-c.m. M.L.R. (Armstrong), 6 25-c.m. do., 6 l., 6 M.	..	1872	..	12·00	513	1780

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2 batteries.	**Re Umberto** (3) . .		13,251	400	0	75	5	..	..	..	28	6	2	19,000	4 43-c.m. (110 ton) B.L.R. (Armstrong), 12 15-c.m. do., 6 7½-c.m. do., 10 M.	..	..	..	18·00	—	—
c.b.	(*Roma*) . .	(wood)	5814	262	6	55	9	4½	4¼	26	25	3	1	3000	11 22-c.m. M.L.R., (Armstrong), 6 l., 6 M.	..	1865	..	13·00	511	1940
b.	**Ruggiero di Lauria** (1) .	(steel)	11,000	328	2	65	4	..	17¾ comp.	..	27 (mean)	2	2	10,000	4 43-c.m. (110 ton) B.L.R. (Armstrong), 12 15-c.m. do., 6 l., 12 M.	3 tu.	1884	..	16·00	850	4500
c.b.	**San Martino** . . .		4268	246	0	49	4	4½	4¼	14	22	7	1	2620	2 22-c.m. M.L.R. (Armstrong), 9 20-c.m. do., 6 l., 6 M.	..	1863	..	12·00		
,,	**Sardinia** (3) . . .		13,251	400	0	75	6	..	..	..	28	6	2	19,000	4 43-c.m. (110 ton) B.L.R. (Armstrong), 12 15-c.m. do., 6 7½-c.m. do., 10 M.	..	..	..	18·00	1200	—
,,	**Sicilia** (3)		13,251	400	0	75	6	..	..	..	28	6	2	19,000	4 43-c.m. (110 ton) B.L.R. (Armstrong), 12 15-c.m. do., 6 7½-c m. do., 10 M.	..	..	..	18·00	1200	—
c.b.	**Terribile**		2725	210	0	45	11	4½	..	9	18	0	1	1100	8 20-c.m. M.L.R. (Armstrong), 6 l., 4 m.	..	1861	112,454	7·00	—	—
a.g.b.	**Varese**		2000	200	0	42	7	4½	..	9	15	9	2	977	4 20-c.m. M.L.R. (Armstrong), 6 l., 4 M.	..	1865	85,000	10·00	—	—

(For Notes on Italian Armoured Ships see page 250.)

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ITALY.—Unarmoured Ships.

corv., corvette; *d.v.*, despatch vessel; *g.v.*, gun-vessel; *fr.cr.*, frigate-built cruiser; *s,g.to.*, sea-going torpedo boat; *to.cr.*, torpedo cruiser; *to.r.cr.*, torpedo-ram cruiser; *to.s.*, torpedo ship; P., deck protected throughout.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armaments.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
d.v.	**Agostino Barbarigo** .	656	216 6	23 11	steel	10 10	1	1700	2 12-c.m. B.L.R. (Armstrong), 2 M. .	..	1879	..	15·00	80	1000
corv.	**Amerigo Vespucci** P .	2533	255 11	42 7	„	17 0	1	5000	8 15-c.m. B.L.R., 3 l., 6 M. . . .	..	1882	..	15·00	—	—
g.v.	**Andrea Provana** . .	649	167 4	26 3	„	10 2	1	1000	6 12-c.m. B.L.R., 1 M.	..	1884	..	12·00	—	—
corv.	**Caracciolo** . . .	1578	209 11	36 0	wood	16 5	1	973	6 16-c.m., 1·8-c.m. do., 1 l., 4 M. .	..	1869	..	10·00	—	—
g.v.	**Cariddi**	1050	177 2	28 6	„	12 5	1	956	2 12-c.m. B.L.R., 1 16-c.m., 2 l., 4 M. .	..	1875	..	10·00	—	—
corv.	**Cristoforo Colombo** . .	2362	249 4	36 0	wood & iron	17 4	1	3782	8 12-c.m. B.L.R., 2 l., 4 M. . . .	..	1875	..	15·00	471	3600
	(Two Gun Despatch Vessels not yet named) . .	1940	177 3	32 8	steel	13 6	1	1100	6 5-inch B.L.R.	..	bldg	..	12·00	197	—
to.r.cr.	**Etna** P	3530	282 2	42 7	„	19 0	2	6000	2 25-c.m. B.L.R. (Armstrong), 4 15-c.m. do., 2 l., 8 M.	tu.	1885	64,000 (engines)	17·00	—	—
„	**Fieramosca** P . . .	3680	290 0	43 6	„	19 4	2	7700	2 25-c.m. B.L.R., 6 6-inch B.L.R. .	tu.	bldg	..	17·00	590	—
corv.	**Flavio Gioja** P . . .	2533	255 11	42 7	„	17 0	1	5000	8 15-c.m. B.L.R. (Armstrong), 3 l., 6 M.	...	1881	..	15·00	—	—
s.g.to.	**Folgore**	317	187 0	19 8	..	6 7	1	2400	— —	—	—	—	—	—	—
fr.cr.	**Garibaldi**	3376	223 2	49 3	wood	20 11	1	1041	8 16-c.m., 2 8-c.m., 4 l., 4 M. . .	..	1860	..	9·00	—	—
to.r.cr.	**Giovanni Bausan** (1) P .	3068	275 7	42 7	steel	18 4	2	6000	2 25-c.m. B.L.R. (Armstrong), 6 15-c.m. B.L.R., 2 l., 4 M.	3 tu.	1883	160,000	17·50	600	5000
to.cr.	**Goito**	741	229 7	25 7	„	9 2	2	3600	— —	—	—	—	—	—	—
d.v.	**Marcantonio Colonna** .	656	216 6	23 11	„	10 10	1	1700	2 12-c.m. B.L.R. (Armstrong), 2 M. .	..	1879	..	16·00	—	—
to.s.	**Pietro Micca** . . .	535	203 5	19 7	iron	11 10	1	972	2 M.	..	1876	..	7·00	—	—
d.v.	**Rapido**	1456	262 5	30 6	„	12 6	2	1920	5 7½-c.m. B.L.R. (Armstrong), 2 M. .	..	1876	..	13·00	300	2560

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g.to.	**Saetta**	317	187	0	19	8	steel	6	7	1	2400	—	—	—	—	—	—	—	—
corv.	**Savoia P**	2850	275	6	42	7	„	17	0	1	5000	6 15-c.m. B.L.R. (Armstrong), 4 l., 6 M.	..	1883	..	15·00	—	—
g.v.	**Scilla**	1050	177	2	28	6	wood	12	5	1	826	2 12-c.m. B.L.R. (Armstrong), 1 16-c.m., 2 l., 4 M.	..	1874	..	10·00	—	—
„	**Sebastiano Veniero** . .	649	167	4	26	3	steel	10	2	1	1000	6 12-c.m. B.L.R., 1 M.. . . .	..	1884	..	12·00	—	—
d.v.	**Stafetta**	1505	252	7	30	10	iron	13	2	2	1800	4 12-c.m. B.L.R., 1 l., 2 M. . . .	..	1876	..	15·00	300	3300
to.r.cr.	**Stromboli P**	3530	282	2	42	7	steel	19	0	2	6000	2 25-c.m. B.L.R. (Armstrong), 4 15-c.m., 2 l., 8 M.	tu.	1885	64,000 (Engines)	17·00	—	—
to.cr.	**Tripoli** and two sister ships not yet named . . .	741	229	7	25	7	„	9	2	2	3600	—	—	..	bldg	..	18·00	180	—
d.v.	**Vedetta**	827	183	9	26	11	iron	11	5	1	670	4 12-c.m. B.L.R., 1 l., 2 M. . . .	..	1866	..	11·00	—	—
to.r.cr.	**Vesuvio P.**	3530	282	2	42	7	steel	19	0	2	6000	2 25-c.m. B.L.R. (Armstrong), 4 15-c.m., B.L.R., 2 l. 8 M.	tu.	bldg	64,000 (Engines)	17·00	590	—
d. v.	(Four Vessels not named) .	770	229	8	26	3	steel	8	2	1	1700	4·5 inch B.L.R.	..	Bldg. at Venice.	..	15·00	210	—
fr.cr.	**Vettor Pisani** . . .	1703	213	3	39	4	wood	16	5	1	1004	10 12-c.m. B.L.R., 2 l., 4 M. . .	..	1869	..	9·00	—	—

Besides the ships of which the names are given in the foregoing tables, Italy has

Gunboats (*Staunch class*).—Guardiano and Sentinella; of 265 tons, and of 231 and 260 I.H.P. respectively; 6 small gunboats of 87 tons and 52 H.P.

Paddle despatch vessels.—Exploratore, Messaggiero; of 1245 tons, and of 1615 I.H.P.

Also transports, surveying vessel, training ships, harbour and coasting-service craft, &c.

Torpedo boats.—First class, 62; 24 being sea-going, built or building; second class, 21.

There are nine merchant steamers of more than 3000 tons on the auxiliary list. Of these, three are fitted for two torpedo-launching apparatus.

(1) The Giovanni Bausan, built by Sir W. Armstrong and Co., is of the Esmeralda type, but longer. She has an armour deck with plates 1½-inch thick. All the guns have a steel shield. A torpedo-launching tube is fitted under the ram in the keel-line. There are two other launching positions above water. The steering gear is hydraulic. On the trial 6000 horse-power was indicated, and the speed was 17·5 knots per hour.

A torpedo ship not yet named of 2000 tons displacement and 19 knots speed, carrying 6 6-inch B.L.R. guns, and 9 6-pr. Q.F. guns is now building.

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NOTES ON THE ITALIAN NAVY.—ARMOURED SHIPS.

Andrea Doria.

(1) The Andrea Doria, Francesco Morosini, and Ruggiero di Lauria, are of similar type. They have an armoured barbette citadel, the axis of which makes an angle of 30° with the keel-line. In the citadel four 110-ton B.L.R. Armstrong guns are mounted on two turrets which are unarmoured. The guns may therefore be said to be "en barbette." They are covered by bullet-proof shields. The hull above the armour deck, which is beneath the water-line, is cellular. The ammunition supply shafts, the bases of the funnels, and the boiler-rooms, are protected by armour. The coal supply is 850 tons, sufficing for 4500 miles at half-speed. There are three torpedo-launching stations. The ships have each one mast.

Italia and Lepanto.

(2) These are the largest armoured ships in the world, and will probably be the fastest as well as the most powerfully armed. As the steam trials of the first of them are not completed, the actual maximum performance of the engines, and the corresponding speed, cannot be given.

The buoyancy and stability of these ships are not protected by side armour. There is no belt of armour, not even a short one. There is a vast and well-considered cellular construction at the water-line, and a very large quantity of thick internal armour protecting passages, and gun mechanism.

Re Umberto.

(3) The three ships of this class are understood to be not finally settled as to dimensions.

They are to have an assured eighteen knots' speed, and will probably be longer and larger than the Italia class.

In these ships also side armour has been deliberately abandoned in favour of cellular construction at the water line.

It is understood that the horizontal, or nearly horizontal, deck forming the base of this cellular structure, will be nearer the water level, and therefore of necessity much thicker than in the Italia class.

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JAPAN.—Armoured Ships.

a.c., armoured cruiser; *br.*, broadside ship; *c.b.*, central-battery ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery.					Guns.	Torpedoes.					
Ram	*Adsuma-Kan* . . (wood) (was Stonewall Jackson)	tons. 1300	ft. in. 157 5	ft. in. 26 11	inches. 4	inches. 4	inches. ..	ft. in. 13 3	2	700	1 9-in. M.L.R. (Armstrong), 4 6½-in. do.	..	1864	£ ..	knots. 9·00	tons. ..	knots. ..
c.b.	**Fu-Soo** . . .	3718	220 0	48 0	7	9	..	18 4	2	3500	4 24-c.m. B.L.R. (Krupp), 2 17-c.m. do., 6 l., 5 M.	..	1877	..	13·2	..	4500
a.c.	*Hi-yei* * . . . (wood)	2200	231 0	40 9	4½	..	..	17 4	1	2490	2 17-c.m. B.L.R. (Krupp), 6 15-c.m. do.	..	1878	..	13·0	280	..
„	*Kin-go* * . . . (wood)	2200	231 0	40 9	4½	..	..	17 4	1	2450	2 17-c.m. B.L.R. (Krupp), 6 15-c.m. do.	..	1877	..	13·70	280	..
br.	*Rio-jio-kan* . . (wood)	1459	213 3	34 5	4½	4	..	17 4	1	975	2 17-c.m. B.L.R. (Krupp), 6 70-pdr. (Vavasseur).	..	1864	..	9·00	..	..

* These are not armoured ships in the usual sense of the term. There is no armour as against end-on fire and no armoured deck.

JAPAN.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *d.v.*, despatch vessel; *g.v.*, gun-vessel; P., deck protected throughout.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
c.r.	**Akagi**	tons. 1760	ft. in. 230 0	ft. in. 33 0		ft. in. 13 0	2	2300	4 6-inch B.L.R., 1 4¾-inch do. . . .	..	bldg	..	knots. 15·00	tons. —	knots. —
d.v.	**Amaki**	908	196 10	29 6	wood	13 9	1	720	1 15-c.m. B.L.R. (Krupp), 4 12-c.m, do, .	..	1877	..	11·00	—	—
corv.	**Asama**	1104	206 9	33 9	„	10 10	1	300 (nom.)	8 17-c.m. B.L.R. (Krupp), 4 4½-in, do. (Armstrong), 4 l.	—	—	—	—	—	—
d.v.	**Gwaki**	600	146 4	25 3	„	12 2	1	650	1 15-c.m. B.L.R. (Krupp), 2 12-c.m, do, .	..	..	..	10·00	—	—
g.v.	**Banjo**	595	154 0	25 0	„	12 0	1	590	1 6-inch B.L.R., 1 4¾-inch do. . . .	..	1879	..	10·00	107	—

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corv.	**Kaimon**	1490	200	0	32	0	wood	16	5	1	1250	1 17-c.m. B.L.R. (Krupp), 6 12-c.m. do., 2 l.	..	1882	..	12·00	—	—
g.v.	**Katsuraki**	1476	206	9	36	0	composite	15	0	2	1600	2 17-c.m. B.L.R. (Krupp), 5 12-c.m. do., ? M.	..	1885	..	13·00	—	—
„	**Muzasi**	..	..		..		steel	..		..	1600	— —	—	—	—	—	—	—
cr.	**Naniwa** (1) P.	3600	298	6	46	0	steel	18	4	2	7500	2 26-c.m. B.L.R. (28 tons) (Armstrong), 6 15-c.m. (Krupp), 14 M., 2 Q.F.	4 tu.	1885	..	18·00	800	9000 at 13 kts.
„	**Nawa**	..	..		..		steel	..		2	3800	— —	—	—	—	—	—	—
d.v.	**Nis-chin**	874	204	0	29	0	wood	14	6	1	1270	1 7-in. M.L.R. (Armstrong), 6 30-pdr. (smoothbore)	..	..	..	11·00	—	—
„	**Sei-ki**	810	192	0	30	0	wood	13	2	1	720	1 15-c.m. B.L.R. (Krupp), 3 12-c.m. do.	..	1875	..	11·00	—	—
cr.	**Takao**	..	..		..		..	..		2	2330	.. ..	..	1885	..	18·00	—	—
cr.	**Takatschio** (1) P.	3600	298	6	46	0	steel	18	4	2	7500	2 26-c.m. B.L.R. (28 tons) (Armstrong), 6 15-c.m. do., 14 M., 2 Q.F.	4 tu.	1885	..	18·00	800	9000 at 13 kts.
corv.	**Ten-rio**	1490	200	0	32	0	wood	16	5	1	1250	1 17-c.m. B.L.R. (Krupp), 6 12-c.m. do., 2 l.	..	1882	..	12·00	—	—
cr.	**Tscho-kai**	1350	210	0	32	3	steel	15	0	2	2700	1 10-in. 25-ton B.L.R., 4 4-in. do.	..	bldg.	..	16·00	250	—
„	**Tsukushi**	1500	210	0	35	2	steel	15	0	1	2887	2 10-in. B.L.R. (Armstrong), 4 5-in. do., 2 l., 4 M.	tu.	1882	..	17·00	—	—
„	**Unebi** (2) P.	3651	321	6	43	0	steel	18	9	1	6000	4 24-c.m. B.L.R. (18 tons), 4 15-c.m. do., 12 M.	tu.	bldg.	..	15·00	—	—
g.v.	**Yamato**	1476	206	9	36	0	composite	15	0	2	1600	2 17-c.m. B.L.R. (Krupp), 5 12-c.m. do., 2 M.	2 tu.	1885	..	13·00	—	—

Paddle despatch vessel.—Jungei, 1465 tons; 1430 H.P.; Kasuga, 1015 tons; 300 nom. H.P.

Gunboats.—Dai-itschi-Teibo, Ho-schio, Moschium, Raiden, Tschintagata; 100 to 375 tons; 60 to 80 nom. H.P.; and the Atago and Maja, 620 tons and 700 I.H.P.

One sea-going torpedo boat building at Poplar.

Four first-class torpedo boats (not sea-going).

Also yachts, training-ships, transports, &c.

(1) The Naniwa was built by Sir W. Armstrong & Co., and the engines are by Hawthorn & Co. The vessel, and her sister, the Takatschio, bear considerable resemblance to the Esmeralda.

(2) The Unebi was built for the Japanese Government in France.

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MEXICO.—Unarmoured Ships.

g.v., gun-vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at ten knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
g.v.	**Democrata**	450	140 0	24 10	iron	11 2	1	600	2 20-pdr. B.L.R. (Vavasseur) . .	..	1875	..	11·00	..	—
„	**Mexico**	450	140 0	24 10	„	11 2	1	600	2 20-pdr. B.L.R. (Vavasseur) . .	..	1875	..	11·00	..	—

Mexico has also three gunboats of small size.

NETHERLANDS.—Armoured Ships.

a.g.b., armoured gunboat; *c.s.*, coast-service vessel; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Turret.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.s.t.	**Bloedhond** . . .	1530	180 0	46 3	5½	8	9¾	9 6	2	680	1 28-c.m. B.L.R. (Krupp), 2 M. .	..	1869	..	8·50	—	—
„	**Buffel**	2198	195 6	40 0	6	8	9¾	15 6	2	2000	2 23-c.m. M.L.R. (Armstrong), 2 M.	..	1868	..	12·40	—	—
c.s.t.	**Cerberus**	1530	180 0	44 0	5½	8	9¾	9 7	2	617	1 28-c.m. B.L.R. (Krupp), 2 M. .	..	1869	..	8·50	—	—
c.s.t.	**Draak**	2156	201 5	49 3	8	9	11¾	10 10	2	807	2 28-c.m. B.L.R. (Krupp), 2 M. .	..	1877	..	8·00	100	—
„	**Guinea**	2378	195 6	40 0	6	8	9¾	16 9	2	2000	2 23-c.m. B.L.R. (Armstrong), 2 M.	..	1870	..	12·00	—	—
c.s.t.	**Haai**	1566	186 4	44 0	5½	8 5½ C. T.	9¾	10 2	2	672	2 23-c.m. B.L.R. (Armstrong), 2 M.	..	1871	..	7·00	70	—

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„	Heiligerlee . . .	1530	180	0	43	7	5½	8 4½ C. T.	9¾	9	6	2	630	2 23-c.m. B.L.R. (Armstrong), 2 M.	..	1868	..	8·00	—	—
„	Hijena	1566	186	4	44	0	5½	8 5¼ C. T.	9¾	10	2	2	654	2 23-c.m. M.L.R. (Armstrong), 2 M.	..	1871	..	7·00	70	—
a.g.b.	Isala	367	150	11	24	11	4	5	5	4	3	2	306	2 12-c.m. B.L.R. (Krupp) . .	..	1876	..	8·00	—	—
t.	Koning der Nederlander	5400	269	0	49	3	8	9 8 P. H.	11¾	20	0	1	4500	4 28-c.m. M.L.R. (Armstrong), 4 12-c.m. B.L.R. (Krupp)	..	1874	..	11·00	620	—
c.s.t.	Krokodil . . .	1530	180	0	43	7	5½	8 4½ C. T.	9¾	9	6	2	630	2 28-c.m. B.L.R. (Krupp), 2 M. .	..	1868	..	8·00	—	—
„	Luipard	1525	186	4	44	0	5½	8 4½ C. T.	9¾	9	2	2	680	1 28-c.m. B.L.R. (Krupp), 2 M. .	..	1876	..	7·00	70	—
„	Matador	1935	201	5	49	3	5½	9	9¾	10	2	2	691	2 28-c.m. B.L.R. (Krupp), 2 M. .	..	1878	..	7·00	100	—
a.g.b.	Merva	367	150	11	24	11	4	5	5	4	3	2	395	2 12-c.m. B.L.R. (Krupp) . .	..	1879	..	8·00	—	—
„	Mosa	367	150	11	24	11	4	5	5	4	3	2	400	2 12-c.m. B.L.R. (Krupp) . .	..	1878	..	8·00	—	—
c.s.t.	Panter	1566	186	4	44	0	5½	8 5¼ C. T.	9¾	10	2	2	560	2 23-c.m. B.L.R. (Armstrong), 2 M.	..	1870	..	7·00	70	—
t.	Prinz Hendrik der Nederlander	3375	229	7	42	7	4½	5½	9¾	18	1	1	2000	4 23-c.m. M.L.R. (Armstrong), 4 12-c.m. B.L.R. (Krupp)	..	1866	..	12·00	300	—
a.g.b.	Rhenus	367	150	11	24	11	4	5	5	4	3	2	310	2 12-c.m. B.L.R. (Krupp) . .	..	1877	..	8·00	—	—
c.s.t.	Schorpionen . . .	2175	193	3	38	0	6	8 4½ P. T.	11¾	18	10	2	2225	2 28-c.m. B.L.R. (Krupp) . .	..	1868	..	12·00	200	1030
„	Stier.	2069	194	10	38	0	6	8 4½ P. T.	9¾	19	3	2	2257	1 28-c.m. B.L.R. (Krupp), 2 M. .	..	1868	..	12·00	—	—
„	Tijger	1414	187	0	44	0	5½	8 4½ C. T.	9¾	8	10	2	684	2 23-c.m. M.L.R. (Armstrong), 2 M.	..	1868	..	8·00	—	—
a.g.b.	Vahalis	340	120	5	27	6	4½	..	7	5	3	2	243	2 7½-c.m. B.L.R. (Krupp) . .	..	1870	..	8·00	—	—
c.s.t.	Wesp	1566	186	4	44	0	5½	8	9¾ 5¼ C. T.	10	2	2	744	1 28-c.m. B.L.R. (Krupp), 2 M. .	..	1871	..	7·00	70	—

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NETHERLANDS.—Unarmoured Ships.

((I) denotes vessels of the Dutch Indian Navy.)
corv., corvette; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at ten knots.
									Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
sl.	**Alkmar** . . .	1010	154 3	30 2	composite	15 9	1	732	1 15-c.m. B.L.R., 6 12-c.m. do. (Krupp) .	..	1874	..	11·00	—	—
g.v.	**Aruba**	770	147 7	29 6	„	12 5	1	413	1 15-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp), 2 M.	..	1873	..	9·00	—	—
fr.cr.	**At-jeh**	3160	262 5	39 4	iron & wood	20 7	1	2700	6 17-c.m. B.L.R., 8 12-c.m. do. (Krupp), 6 M.	..	1876	..	13·00	280	—
g.v.	**Bali** (I) . . . (was Eustatius)	853	147 7	29 6	„	11 10	1	416	1 15-c.m. B.L.R., 3 12-c.m. do. (Krupp), 2 M.	..	1878	—	—	—	—
„	**Banda** (I) . . .	695	137 10	27 7	composite	11 10	1	198	1 16-c.m. M.L.R., 2 12-c.m. B.L.R. (Krupp) .	..	1872	..	9·00	—	—
„	**Bandjermassin** (I) .	732	137 10	28 10	„	11 10	1	370	1 18-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp).	..	1874	..	9·50	—	—
„	**Batavia** (I) . . .	853	147 7	29 6	iron & wood	11 10	1	405	1 18-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp).	..	1876	..	9·00	—	—
„	**Bencoolen** (I) . .	853	147 7	29 6	„	11 10	1	516	1 15-c.m. B.L.R., 3 12-c.m. do (Krupp) .	..	1879	..	9·00	—	—
„	**Bonaire** . . .	853	147 7	29 6	iron & wood	11 10	1	412	1 15-c.m. B.L.R., 3 12-c.m do. (Krupp), 2 M.	..	1877	..	9·00	—	—
corv.	**Curaçoa** (I). . .	2030	190 3	39 4	wood	18 4	1	680	8 16-c.m. M.L.R.	..	1863	..	—	—	—
fr.cr.	**De Ruyter** . . .	3160	262 5	39 4	iron & wood	20 7	1	3305	6 17-c.m. B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	1880	..	15·00	280	—
cr.	**Java**	1100	197 0	31 3	„	12 3	1	1020	.. .. ..	..	1885	..	10·60	125	—
„	**Johan Willem Friso** .	3160	262 5	39 4	„	20 7	1	3000	6 17-c.m. B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	bldg.	..	15·00	—	—
„	**Koningin Emma der Nederlanden**	3160	262 5	39 4	„	20 7	1	2750	6 17-c.m. B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	1879	..	14·00	280	—
corv.	**Leeuwarden** . .	2030	190 3	39 4	wood	18 4	1	738	4 16-c.m. B.L.R., 6 12-c.m. do. (Krupp), 2 M.	..	1861	..	8·00	—	—

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g.c.	**Macassar (I)** . .	853	147 7	29 6	iron & wood	11 10	1	394	1 18-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1876	..	9·00	—	—
„	**Madura (I)** . .	853	147 7	29 6	„	11 10	1	559	1 15-c.m. B.L.R., 3 12-c.m. do (Krupp) .	..	1880	..	9·00	—	—
„	**Padang (I).** . .	853	147 7	29 6	„	11 10	1	409	1 15-c.m. B.L.R., 3 12-c.m. do. (Krupp) .	..	1878	..	9·00	—	—
„	**Palembang (I)** . .	732	137 10	28 10	composite	11 10	1	370	1 18-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1874	..	9·50	—	—
„	**Pontianak (I)** . .	832	147 7	29 6	„	11 10	1	360	1 18.-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1873	..	9·50	—	—
„	**Riow (I)** . . .	832	147 7	29 6	„	11 10	1	204	1 16-c.m. M.L.R., 2 12-c.m. B.L.R. (Krupp)	..	1872	..	9·00	—	—
„	**Samarang (I)** . .	853	147 7	29 6	iron & wood	11 10	1	460	1 18-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1876	..	9·00	—	—
„	**Sambas (I)** . . .	732	137 10	28 10	composite	11 10	1	374	1 18-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1874	..	9·50	—	—
„	**Sommelsdijk** . .	890	147 7	31 2	iron & wood	11 9	1	732	1 15-c.m. B.L.R., 3 12-c.m. do. (Krupp), 2 l.	..	1882	..	9·00	—	—
„	**Surinam** . . .	853	147 7	29 6	„	11 10	1	440	1 15-c.m. B.L.R. (Krupp), 3 12-c.m. do., 2 l.	..	1877	..	9·00	—	—
fr.cr.	**Tromp.** . . .	3160	262 5	39 4	„	20 7	1	2772	6 17-c.m. B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	1877	..	14·00	280	—
corv.	**Van Galen** . . .	2160	190 3	39 4	wood	18 2	1	833	4 16-c.m. B.L.R., 6 12-c.m. do. (Krupp), 2 M.	..	1872	..	10·00	—	—
fr.cr.	**Van Speyk** . . .	3160	262 5	39 4	iron & wood	20 7	1	3000	6 17-c.m. B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	1882	..	15·00	—	—
corv.	**Zilveren Kruis** . .	2160	193 6	42 7	wood	18 4	1	1140	4 16-c.m. B.L.R., 6 12-c.m. do. (Krupp), 4 M.	..	1869	..	10·00	—	—

Gunboats (*Staunch class*).—Balder, Braga, Bulgia, Dufa, Freijr, Hadda, Hefring, Heimdall, Njord, Thor, Tijr, Udur, Ulfr, Vali, Vidr, Wodan, of 245 tons; also, Bever, Brak, Das, Dog, Ever, Fret, Geep, Gier, Havik, Hydra, Lynx, Ruaf, Sperwer, Vos, of 195 tons.

Steel gunboat.—"No. 3," 108 tons and 172 I.H.P.

First-class torpedo boats, two, and one sea-going (building); *second class*, twenty.

Also several large paddle steamers, training ships, transports, store ships, surveying vessel, &c.

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NORWAY.

(See Sweden and Norway.)

PERU.

Since the war with Chili the Peruvian Navy has been much reduced, and comprises only the following sea-going steamers:—

Callao, Colon, Diogenes, Duque de Guisa, Iquique, Lerzundi, Rimac (2100 tons, 13 knots), Socrates, Tumbez, and the training rigate Apurimac.

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PERSIA.

d.v., despatch vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
d.v.	**Persepolis** . . .	1200	206 9	34 2	steel	19 7	1	454	1 10-c.m. B.L.R. (Krupp), 4 7-c.m. do . .	..	1885	..	10·00	—	—

Also one small double-screw steamer for police duties.

PORTUGAL.—Armoured Ship.

c.b., central battery-ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery.					Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.b.	**Vasco da Gama** .	2422	200 0	40 0	9	10	..	18 0	2	3605	2 26-c.m. B.L.R. (Krupp), 2 15-c.m. do., 3 40-pdr. B.L.R. (Armstrong), 1 M.	..	1876	103,800	13·20	300	—

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PORTUGAL.—Unarmoured Ships.

corv., corvette; *g.v.*, gun-vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
corv.	Affonso de Albuquerque	1111	205 0	33 2	iron & wood	12 3	1	1055	7 6-in. B.L.R. (Armstrong), 5 5-in. do., 3 M.	..	1884	..	11·00	—	—
„	Bartholomeu Dias	1243 (tonnage)	207 0	37 5	wood	20 6	1	400 (nom.)	17 M.L.R.	..	1858	..	10·00	—	—
g.v.	Bengo	462	125 7	24 7	composite	8 10	1	90 (nom.)	3 15-c.m. B.L.R.	..	1879	..	8·00	—	—
„	Diego Cam	587	143 0	25 11	„	10 10	1	100 (nom.)	2 15-c.m. B.L.R.	..	bldng.	..	9·00	—	—
„	Douro	587	143 0	25 11	„	10 10	1	100 (nom.)	2 15-c.m. B.L.R.	..	1873	..	9·00	—	—
corv.	Duque de Terceira	1418	180 2	34 2	wood	14 9	1	220 (nom.)	1 17-c.m. M.L.R. (Armstrong), 4 40-pdr. do.	..	1864	..	10·00	—	—
„	Estephania	2368	202 5	41 4	„	17 8	1	400 (nom.)	9 M.L.R.	..	1859	..	10·00	—	—
g.v.	Liberal	447 (tonnage)	140 0	25 10	iron & wood	12 0	1	500	1 6-in. B.L.R. (Armstrong), 2 l., 6 M.	..	1884	..	16·00	—	—
corv.	Mindello	1124	169 11	35 9	composite	13 5	1	900	2 7-in. M.L.R. (Armstrong), 4 20-pdr. do., 2 l.	..	1876	..	10·00	—	—
g.v.	Mondovi	462	125 7	24 7	„	8 10	1	90 (nom.)	3 15-c.m. B.L.R.	..	1879	..	8·00	—	—
„	Quauza	587	143 0	25 11	„	10 10	1	100 (nom.)	3 15-c.m. B.L.R.	..	1877	..	8·00	—	—
corv.	Rainha de Portugal	1124	169 11	35 9	„	13 5	1	900	2 7-in. M.L.R. (Armstrong), 4 20-pdr. do., 2 l.	..	1876	..	10·00	—	—
g.v.	Rio Lima	539 (tonnage)	148 11	28 3	„	10 6	1	100 (nom.)	1 15-c.m. B.L.R. (Armstrong), 4 40-pdr. do.	..	1875	..	9·00	—	—
„	Sado	539 (tonnage)	148 11	28 3	„	10 6	1	100 (nom.)	1 15-c.m. B.L.R. (Armstrong), 4 40-pdr. do.	..	1875	..	9·00	—	—
„	Tamega	539 (tonnage)	148 11	28 3	„	10 6	1	100 (nom.)	1 15-c.m. B.L.R. (Armstrong), 4 40-pdr. do.	..	1875	..	9·00	—	—
„	Tejo	587	143 0	25 11	„	10 10	1	100 (nom.)	2 15-c.m. B.L.R.	..	1869	..	8·00	—	—
„	Vouga	721	161 0	27 7	iron & wood	11 10	1	150 (nom.)	5 M.L.R. guns	..	1882	—	—	—	—
„	Zaire	447 (tonnage)	140 0	25 10	iron	11 10	1	500	1 6-in. B.L.R. (Armstrong), 2 l., 6 M.	..	1884	..	16·00	—	—
„	Zambezia	590	143 0	26 0	composite	10 10	1	400	2 6-in. B.L.R.	...	bldng.	..	9·00	80	—

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Gunboat.—Rio Ave, 378 tons; 60 nom. H.P.

Torpedo boat.—Espadarte.

Three torpedo boats, 110 feet long, 12 feet broad, 60 tons displacement, 700 indicated horse-power, 20 knots speed, are building at Poplar.

Torpedo vessel.—Fulminante.

Three transports, seven screw steamers built and building, besides training ships, yachts, &c.

ROUMANIA.

The Kingdom of Roumania has—

Five gunboats of small size (45 to 110 tons).

Two paddle yachts.

One screw steamer (2 guns, 2 machine guns).

One towing torpedo steamer.

Two second-class torpedo boats.

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RUSSIA.—Armoured Ships.

(B.S., Black Sea Fleet.)

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Turret or Battery.					Guns. B.L.R. are of Russian Krupp pattern.	Tor-pedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	ins.	ft. in.						£	knots.	tons.	knots.
t.	Adm. Chichagoff (Iron)	3511	254 3	42 7	6	6	17½	18 9	1	2060	2 11-in. B.L.R., 4 l., 3 M.	..	1868	..	10·00	—	—
„	Adm. Greig (Iron)	3593	252 7	42 7	4½	6	17½	20 11	1	2031	3 11-in. B.L.R., 4 l., 3 M.	..	1868	..	10·00	—	—
„	Adm. Lazareff	3556	252 7	42 7	4½	6	17½	20 4	1	2004	3 11-in. B.L.R., 4 l.	—	1867	—	10·00	—	—
a.c.	Admiral Nachimoff (1) (steel and iron and wood sheathed)	7781	330 0	61 0	10	13¾	..	25 9	2	8000	4 9-in. B.L.R., 10 6-in. do., 4 l., 6 M. (see note).	4 tu.	1885	262,500 ? for hull only.	16·00	950	—
t.	Adm. Spiridoff	3740	254 3	42 7	6	6	17½	19 1	1	2007	2 11-in. B.L.R., 4 l., 3 M.	..	1868	..	10·00	—	—
b.	Alexander II. (2) (steel)	8637	326 0	67 0	14	12 barbette	..	23 0 (mean)	2	8500	2 12-in. B.L.R., 4 9-in. do., 8 6-in. do., 4 l., 6 M.	4 tu.	Bldg.	..	15·00	—	—
c. b.	Alexander Nevsky	7572	..	..	..	..	..	..	2	..	2 8-in. B.L.R.; 14 6-in.	..	Bldg.	..	16·00	—	—
c.s., t.	Bronenosetz	1482	200 0	45 11	5 1-in. plates	11 1-in. plates	..	12 2	1	481	2 9-in. B.L.R.	..	1864	..	7·00	—	—
b.	Catherine II. (3) B.S. (iron and steel)	10,150	313 4	69 0	16	14 barbette	..	26 0 (mean)	2	9000	6 12-in. (50-ton) B.L.R., 7 6-in. do., 6 M.	4 tu.	1886	694,000	15·00	886	1350 at 14 knots
c.s., t.	Czarodeika	2026	206 9	42 7	4½	6 turret	17½	12 2	2	786	4 9-in. B.L.R., 1 M.	..	1867	..	8·00	—	—
a.c.	Dimitri Donskoi (4) (iron and steel)	5893	296 5	51 10	6	unarmoured	..	24 4	1	7000	2 8-in. B.L.R., 14 6-in. do., 4 l., 10 M.	4 tu.	1883	..	16·00	..	4800
c.s., t.	Edinorog	1407	200 0	45 11	5 1-in. plates	11 1-in. plates	39	..	1	460	2 9-in. B.L.R.	..	1864	..	6·00	—	—
a.c.	Emperor Nikolas	8450	326 0	67 0	14	..	..	..	..	8000	2 12-in. B.L.R. and other guns	..	Bldg. at St. Petersburg. 16		—	—	
„	General Admiral (Iron and wood)	4604	285 5	49 3	6	unarmoured	9¾	22 11	1	4472	4 8-in. B.L.R., 2 6-in. do., 5 l., 7 M.	2 tu.	1873	..	13·00	1000	—
„	Herzog Edinburgski (Iron and wood)	4602	285 5	49 3	6	unarmoured	9¾	22 11	1	5222	4 8-in., 6 6-in. B.L.R., 6 l., 2 M.	2 tu.	1875	..	13·00	1000	—
c.b.	Kniaz Pojarski	5007	272 4	49 3	4½—3½	4½	..	23 11	1	2835	8 8-in. B.L.R., 2 6-in. do., 8 l., 4 M.	..	1867	..	10·00	600	—

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a.c.	Ship not named (Sachsen type)		9800	377	0	50	0	..	..	..	..	2	5000	.. ..	..	Just commenced at St. Petersburg.					
c.s., t.	**Koldun**		1666	200	0	45	11	5 1-in. plates	11 1-in. plates	39	..	1	481	2 9-in. B.L.R. . . .	..	1864	..	8·00	—	—
br.	**Kreml**		3664	219	10	52	5	6	5½	17½	17	4	1	1121	14 8-in. B.L.R., 6 l., 2 M. .	..	1864	..	8·00	—	—
c.s., t.	**Latnik**		1515	200	0	45	11	5 1-in. plates	11 1-in. plates	39	12	2	1	490	2 9-in. B.L.R. . . .	..	1864	..	6·00	—	—
,,	**Lava**		1591	200	0	45	11	5 1-in. plates	11 1-in. plates	39	12	0	1	335	2 9-in. B.L.R., 2 M. . .	..	1864	..	6·00	—	—
a.c.	**Minin**		6168	298	6	49	3	7	unarmoured	..	25	3	1	5290	4 8-in. B.L.R., 12 6-in. do., 4 l., 3 M.	..	1878 altered	..	13·00	—	—
br.	**Netron-Menya** . .		3494	219	10	52		5½	4½ battery	9¾	16	5	1	1632	14 8-in. B.L.R., 4 l., 2 M. .	..	1864	..	8·00	500	—
a.g.b.	**Nikopol, B.S.** . . .		273	98	5	27	10	3	..	9¾	5	0	2	100 (nom.)	.. ..	..	1868	..	8·00	500	—
circular	**Novgorod, B.S.** . .		2706	101	0	101	0	9—7 with Hughes'.	9	†	13	5	6	2000	2 11-in. B.L.R., 2 l., 2 M. .	..	1873	..	6·00	—	—
c.s., t.	**Perun**		1549	200	0	45	11	5 1-in. plates	11 1-in. plates	..	12	2	1	338	2 9-in. B.L.R. . . .	..	1864	..	6·00	—	—
t.	**Peter the Great** . .		8749	328	2	62	4	14—8	8+6 turret	9¾	23	0	2	8258	4 12-in. 40-ton B.L.R., 4 l., 4 M.	..	1872	..	13·00	1200	—
br.	**Petropaulowski*** . .		6240	294	0	56	0	4½	4½	..	24	0	1	2800	21 8-in. 9 ton B.L.R., 1 6-in do.	..	1865	..	11·00	—	—
br.	**Pervenetz** . . .		3279	219	10	52	5	4½	4½	9¾	14	9	1	1067	1 9-in. mortar, 10 8-in. B.L.R., 2 6-in. do., 4 l., 9 M.	..	1863	..	9·00	—	—
c.s., t.	**Rusalka**		2026	206	9	42	7	4½	6 turret	17½	12	9	2	786	4 9-in. B.L.R., 2 M. . .	..	1867	..	8·00	—	—
br.	**Sevastopol*** .	(wood)	6210	295	0	52	0	4½	4½	..	25	6	1	3090	10 8-in. 9 ton. B.L.R. . .	..	1863	..	12·00	—	—
b.	**Sinopé** (3) .	(steel)	10,150	313	11	69	0	16	14 barbette	..	26 (mean)	0	2	9000	6 12-in. 50-ton B.L.R., 7 6-in. do., 6 M.	4 tu.	..	..	15·00	886	1350 at 14 kts.
a.g.b.	**Sistovo, B.S.** . . .		384	97	9	30	10	3	..	9¾	5	11	2	250	.. ..	..	1868	..	8·00	—	—
c.s., t.	**Smertz**		1520	187	0	39	4	4½	6 turret	7¾	12	2	2	700	2 9-in. B.L.R., 1 M. . .	..	1864	..	8·00	—	—
,,	**Streletz**		1431	200	0	45	11	5 1-in. plates	11 1-in. plates	39	11	6	1	444	2 9-in. B.L.R. . . .	..	1864	..	6·00	—	—
b.	**Tchesmé** (3) **B.S.**	(steel)	10,150	313	11	69	0	16	14 barbette	..	26	0	2	9000	6 12-in. (50 ton) B.L.R., 7 6-in. do., 6 M.	4 tu.	1886	..	15·00	886	1350 at 14 knots
c.s., t.	**Tifun**		1666	200	0	45	11	5 1-in. plates	11 1-in. plates	39	12	5	1	453	2 9-in. B.L.R., 1 M. . .	..	1864	..	6·00	—	—
,,	**Uragan**		1415	200	0	45	11	5 1-in. plates	11 1-in. plates	39	11	6	1	432	2 9-in B.L.R. . . .	..	1864	..	7·00	—	—
circular	**Vice-Admiral Popoff, B.S.**		3590	120	0	120	0	16	16 tower	9	13	5	4	3066	2 12-in. 40-ton B.L.R., 6 l. .	..	1875	..	6·00	—	—
c.s., t.	**Veshtchun** . . .		1448	200	0	45	11	5 1-in. plates	11 1-in. plates	39	11	6	1	529	2 9-in. 15-ton B.L.R. . .	..	1864	..	6·00	—	—
a.c.	**Vladimir Monomach** (5)		5796	304	2	52	6	6 comp.	unarmoured	..	24	11	2	7000	4 8-in. 9-ton B.L.R., 12 6-in. do., 4 3½-in. do., 4 M.	2 tu.	1882	..	15·40	—	—

* These ships are now employed for harbour service. † Hughes' Backing.

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NOTES ON THE RUSSIAN NAVY—ARMOURED SHIPS.

One armour-clad (Sachsen class), 9800 tons, and one of 7572 tons, 7500 I.H.P., are being built for the Baltic Fleet; also one belted cruiser in France, one in Sweden, and several in Denmark.

For the Black Sea Fleet one armour-clad (the Sinope) is being built at Nicholaiev, in addition to the Tchesmé and Catherine II., recently launched; and three others are to be laid down.

The Admiral Nachimoff.

(1) The Admiral Nachimoff is apparently of the British Impérieuse type of armoured cruisers. The hull is built of steel and a certain amount of iron, both these metals being of Russian origin. The stern and stern-post are bronze castings. The latest accounts of the armament of this ship show it as given in the Table; but, according to the *Revue Maritime*, it was formerly intended to have been—four 23-c.m. long B.L.R. guns in the barbette turrets, ten 15-c.m., four light, and six machine guns.

The Alexander II.

(2) The Alexander II. is a barbette ship with a 14-inch armour belt tapering to 6 inches at the extremities, and having a 2½-inch steel deck at its upper edge. The barbette is to carry two long 12-inch B.L.R. guns, and is plated with 12 and 10-inch armour. The main deck has four 9-inch and eight 6-inch guns, not protected by armour. There are four torpedo-launching tubes.

The Catherine II.

(3) The Catherine II., Tchesmé and Sinopé are alike in design. They are barbette ships, with an armour-belt 16 inches at the thickest part, but tapering towards the edges and the ends, running right round the hull, and joining a steel deck 2½ inches thick above. There is on the upper deck a large pear-shaped barbette for six 12-inch long B.L.R. guns mounted on three turntables in pairs. On the main deck there are seven 6-inch guns, one firing right astern. The barbette guns have hydraulic mountings on Lieut. Razkazoff's system. The ships have two steel masts with armed tops. Each ship has four torpedo-launching tubes.

The Dimitri Donskoi.

(4) The Dimitri Donskoi, like the Vladimir Monomach, belongs to the class of water-line armoured, fast cruisers. She differs from the latter in having, instead of twin screws, but one four-bladed propeller, moved by two three-cylinder engines. The armament consists of—on deck two long 21-c.m. (8-inch) B.L.R. guns in the middle of the ship's length, in half-turrets extending beyond the broadside, and ten machine guns. On the main deck are fourteen 15-c.m. (6-inch) long B.L.R. guns of the newest pattern.

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On the lower deck there are four torpedo-launching tubes. The ram protrudes considerably. The ship has six boilers, with furnaces at both ends in two boiler-rooms.

(5) The Vladimir Monomach has four 21-c.m. (8-inch) guns in recessed ports, two firing ahead and two astern with wide arcs of training, twelve 15-c.m. (6-inch) long B.L.R. guns, two Baranoff and two Hotchkiss machine guns. She has also two torpedo launching-tubes. On her official trial in July, 1884, the highest speed obtained was 15·8 knots, and a mean of five runs gave 15·4 knots. The Vladimir Monomach

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RUSSIA.—Unarmoured Ships.

(Bal., Baltic Fleet; B.S., Black Sea Fleet; Sib., Siberian Squadron.)
corv., corvette; *cr.*, cruiser; *d.v.*, despatch vessel; *g.v.*, gun-vessel; *sl.*, sloop; P., deck protected throughout.

On the Russian List are the names of a large number of vessels which cannot be classified on the principles adopted in the British Navy. Many, though used for practically civil purposes, would be available for service of some kind in war. In the following Table steamers, with guns, of over 300 tons are included, and are designated despatch vessels (*d.v.*), or gun-vessels (*g.v.*). Other vessels are placed in the summaries after the Table.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
cr.	Cruizer, not named P.	4300	350 0	48 0	steel & wood	..	2	..	All B.L.R. guns	..	bldng. at Nantes.	—	8·00	—	—
sl.	**Abrek**, Sib.	1069	193 6	29 6	wood	13 1	1	1109	3 6-in. B.L.R., 2 l., 1 M.	..	1860	—	—	—	—
corv.	**Afrika**, Bal.	2852	285 5	39 4	iron	17 1	1	1350	5 6-in. B.L.R., 7 l., 4 M.	..	1877	..	12·00	—	—
„	**Asia**, Bal.	2483	269 0	36 0	„	16 5	1	1100	3 6-in. B.L.R., 5 l., 6 M.	..	1878	..	12·00	—	—
„	**Askold**, Bal.	2245	216 6	39 4	wood	20 4	1	910	8 6-in. B.L.R., 5 l., 5 M.	..	1863	..	10·00	—	—
„	**Bayan**, Bal.	1998	206 9	36 0	composite	18 4	1	978	4 6-in. B.L.R., 5 l., 2 M.	..	1857	..	11·00	—	—
g.v.	**Bobr**, Sib. (1)	950	187 0	35 2	..	10 10	2	1000	1 24-c.m. B.L.R., 1 15-c.m. do., 6 l., 2 M.	..	1884	43,000	14·00	—	—
corv.	**Bogatyr**, Bal.	2204	213 3	39 4	wood	20 4	1	991	8 6-in. B.L.R., 4 l., 1 M.	..	1860	—	10·00	—	—
g.v.	**Bombory**, B.S.	760	160 9	26 3	„	14 5	1	230	2 guns	..	1852	—	—	—	—
corv.	**Djigit**, Bal.	1456	206 9	32 10	iron	16 1	1	1383	3 6-in. B.L.R., 4 l., 4 M.	..	1876	..	12·00	—	—
g.v.	**Don**, B.S.	354	131 3	26 0	steel & wood sheathed	10 2	1	80 (nom.)	2 guns	..	1856	—	—	—	—
„	**Gonez**, B.S.	745	173 10	26 0	iron	12 5	1	160	2 guns.	—	—	—	—	—	—
„	**Gornostai**, Sib.	456	147 7	22 11	wood	8 3	1	150	6 guns	..	1863	—	—	—	—
„	**Ingul**, B.S.	745	173 10	32 10	iron	12 5	1	469	2 guns	..	1872	—	—	—	—

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d.v.	**Japonec**, Sib.. . .	1472	200 2	36 0	wood	12	8	1	300 (nom.)	.. .. ..	..	1858	—	6·00	—	—
g.v.	**Jermak**, Sib. . . .	706	154 3	26 3	iron	11	2	1	125	2 guns	..	1870	—	—	—	—
„	**Kasheck**, B.S. . .	692	167 4	26 3	„	11	2	1	280	2 guns	..	1854	—	—	—	—
„	**Kelasurz**, B.S. . .	307	121 4	19 7	wood	10	5	1	246	— — —	—	—	—	—	—	—
corv.	**Kreyzer**, Bal. . .	542	206 9	32 10	iron & wood	16	1	1	1205	3 6-in. B.L.R., 4 l., 1 M. . . .	..	1875	..	13·00	—	—
g.v.	**Morz**, Sib. . . .	456	147 7	22 11	wood	8	3	1	150	7 guns	..	1860	—	—	—	—
corv.	**Nayezdnik**, Bal. . .	1334	206 9	32 10	composite	14	9	1	1719	3 6-in. B.L.R., 4 l., 5 M. . . .	..	1878	..	13·00	—	—
g.v.	**Nerpa**, Sib . . .	379	124 7	22 11	wood	7	10	1	60 (nom.)	5 guns	..	1860	—	—	—	—
corv.	**Oprichnik**, Bal. . .	1426	206 9	32 10	iron & wood	16	0	1	1685	4 6-in. B.L.R., 2 l., 6 M. . . .	..	1880	..	13·00	—	—
cr.	**Pamyat Merkuriya**, B.S.	3050	292 0	39 4	iron & steel	19	7	1	800	.. .. ..	..	1880	—	14·00	—	—
d.v.	**Penderaklia**, B.S. . .	1052	190 3	29 6	iron	12	8	1	568	3 guns	..	1877	—	—	—	—
g.v.	**Picunda**, B.S. . .	335	127 11	19 7	wood	9	7	1	572	3 guns	..	1857	—	—	—	—
sl.	**Plastun**, Bal. . .	1255	206 9	32 10	composite	14	1	1	1543	3 6-in. B.L.R., 5 l., 4 M. . . .	..	1879	..	12·00	—	—
g.v.	**Prut**, B.S. . . .	339	154 3	23 0	iron	7	3	1	327	2 guns	..	1849	—	—	—	—
„	**Pseznappe**, B.S. . .	335	127 11	19 7	„	10	5	1	216	4 guns	..	1857	—	—	—	—
corv.	**Razbonyik**, Bal. . .	1329	206 9	32 10	iron & wood	14	9	1	1786	3 6-in. B.L.R., 4 l., 5 M. . . .	..	1878	125,000	12·00	—	—
cr.	**Rynda** (2), Bal. P. . .	2950	265 9	45 11	steel & wood sheathed.	16	1	1	3600	10 6-in. B.L.R., 4 l., 6 M. . . .	2 tu.	1885	..	15·00	710	2400
g.v.	**Salgir**, B.S. . . .	360	131 3	23 0	wood	10	5	1	107	.. .. ..	..	1857	—	—	—	—
„	**Sivuz** (1), Sib. . . .	950	187 0	33 2	..	10	10	2	1000	1 24-c.m. B.L.R., 1 15-c.m. do., 6 l., 2 M..	..	1884	43,000	14·00	—	—
corv.	**Skobeleff**, Bal. . .	2397	216 6	39 4	wood	20	0	1	1042	8 6-in. B.L.R., 4 l., 4 M. . . .	..	1862	..	10·00	—	—
g.v.	**Sobol**, Sib. . . .	456	147 7	22 11	„	8	3	1	150	6 guns	..	1863	—	—	—	—
sl.	**Sokol**, B.S. . . .	1057	160 9	32 10	„	15	5	1	346	1 6-in. B.L.R., 8 l., 1 M. . . .	..	1859	—	—	—	—
g.v.	**Souk-Su**, B.S.. . .	307	121 4	19 8	„	10	5	1	317	3 guns	..	1859	—	—	—	—

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RUSSIA.—Unarmoured Ships—*continued.*

(Bal., Baltic Fleet; B.S., Black Sea Fleet; Sib., Siberian Squadron.)

corv., corvette; *cr.*, cruiser; *d.v.*, despatch vessel; *g.v.*, gun-vessel; *sl.*, sloop; *t. b. c.*, torpedo boat-catcher; P., deck protected throughout.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Torpedoes.	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
corv.	**Strjelok**, Bal.	1343	206 9	32 10	iron & wood	14 2	1	1528	3 6-in. B.L.R., 4 l., 4 M.	..	1879	..	13·00	—	—
fr.cr.	**Swjetlana**, Bal.	3200	223 2	49 3	composite	22 4	1	1113	6 8-in. B.L.R.., 6 6-in. do., 5 l., 7 M.	..	1858	..	11·00	—	—
g.v.	**Tamanj**, B.S.	551	173 10	25 11	iron	9 7	1	745	2 guns	..	1849	—	—	—	—
„	**Tunguz**, Sib.	706	154 3	26 3	„	11 2	1	130	4 guns	..	1870	—	—	—	—
„	**Turok**, B.S.	537	134 6	24 11	wood	11 2	1	422	2 guns	..	1846	—	—	—	—
cr.	**Vitiaz** (2), Bal. P.	2950	265 9	45 11	steel & wood sheathed.	16 1	1	3600	8 6-in. B.L.R., 4 l., 6 M.	2 tu.	1884	125,000	15·00	710	2400
sl.	**Vjestnik**, Bal.	1255	206 9	32 10	iron & wood sheathed.	14 2	1	1268	3 6-in. B.L.R., 4 l., 4 M.	..	1879	..	11·00	—	—
corv.	**Vojin**, B.S.	1652	183 9	39 4	wood	17 4	1	875	1 8-in. B.L.R., 5 6-in. do., 4 l., 3 M.	..	1858	—	—	—	—
sl.	**Zabiyaka**, Bal.	1234	219 10	29 6	iron	14 9	1	1470	2 6-in. B.L.R., 5 l., 4 M.	..	1878	..	14·00	—	—
corv.	**Zemsug**, Bal.	1781	239 6	29 6	„	17 4	1	1438	3 6-in. B.L.R., 4 l., 4 M.	tu.	1861	—	—	—	—
Torp. cr.	**Ilyen**	600	229 7	23 11	steel	8 10	2	3500	20 M.	8 tu.	..	..	20·00	—	—
t. b. c.	**Captain Saken**	140	142 0	17 0	„	9 6	2	1300	2 M.	..	bldng. at Nicholaiff.	..	20·00	—	—
Tor. vessel.	**Vzriw**	134	118 2	16 1	iron & wood.	10 10	..	800	.. .. ..	..	1877	..	17·00	—	—
cr.	(New Ship)	3000	..	..	..	..	..	..	.. .. ..	..	Bldg.	..	18·00	—	—

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Two corvettes, Vargag and Vevoda; one cruiser, Europa; two gun-vessels, Gaidamak and Izoovod, and two gun boats, Kartesh and Otliv, are used for Harbour Service only.

Building, one Torpedo ram (Polyphemus class); two torpedo chasers (600 tons, 20 knots, 8 machine guns) for the Baltic Fleet. Several torpedo cruisers, French type (213 feet long, 20 knots), for the Black Sea Fleet. One cruiser (1500 tons), for the Siberian Squadron.

Volunteer (Black Sea) Fleet.—Russia, was Holsatia (3000 tons, 2200 I.H.P., 7 guns, 14 knots); Moskwa (formerly Kinfauns Castle); and St. Petersburg, was Thuringia (3050 tons and 4000 H.P.); Kostromoma; Nijni-Novgorod (was Saxonie); Constantine; Vesta; Argonaut.

Auxiliary Cruisers (Black Sea Fleet).—Czar, Czarevna, Czaritza (5 to 10 12-c.m. B.L.R. gun and numerous machine guns, 16 knots).

Gunboats, Staunch class (Baltic Fleet).—Burja, Burun, Dozd, Grad, Groza, Jorz, Mina, Snjeg, Turza, Wichr (258 to 402 tons, 195 to 472 I.H.P.).

Gunboats (Baltic Fleet).—Korsun, 191 tons, and Szit, 240 tons. Also two building. Seven "steamers" building.

Steamers (Gun vessels, Despatch vessels, &c.) (Black Sea Fleet).—Abin, Ablanova, Batjuska, Bogot, Boltun, Bratec, Brestovitz, Matuska, Rodimyi, Sestrica, Tuabse (90 to 298 tons).

Steamer (Siberian Squadron).—Amur (190 tons).

Also yachts, training ships, paddle steamers, and the Caspian and Lake Aral Flotillas of small vessels.

Torpedo boats (Baltic Fleet)—built and building—ten over 100 feet in length, seventy-four over 70 feet and under 100 feet, twenty under 70 feet, twenty-one not carrying Whitehead torpedoes.

Torpedo boats (Black Sea Fleet)—built and building—twelve over 100 feet in length, eight between 70 feet and 100 feet, six under 70 feet in length, three not carrying Whitehead torpedoes.

Torpedo boats (Siberian Squadron).—Six under 70 feet in length.

NOTES ON THE RUSSIAN NAVY—UNARMOURED SHIPS.

Six new gun boats have just been laid down—May 1886—at the Black Sea Ports; three at Nicholaieff, and three at Sebastopol. Their names are Uraleto, Tereto, Kubareto Laporozeto, Doneto and Cherno Morits. They are to be 210 feet long, 35 feet broad, draft

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10 feet; displacement 1224 tons. Armament of each to be 2 8-inch, 1 6-inch, 2 torpedo, and 6 Hotchkiss guns.

A torpedo boat-catcher is also laid down at Nicholaieff—the Captain Saken.

The Bobr and Sivuz.

(1) The Bobr and Sivuz are double screw gun-vessels, built of steel, with water-tight compartments.

The Rynda and Vitiaz.

(2) The Rynda and Vitiaz are built of steel, and have one four-bladed screw. The hulls are cased with wood and coppered, and there is a steel deck. They have two torpedo tubes, and, according to the *Revue Maritime*, can carry 710 tons of coal, or enough for ten days' steaming.

SARAWAK.

Gunboat.—Aline: length, 142 ft. 6 in.; beam, 21 ft. 3 in.; tonnage, 175; 35 nom. H.P.; 2 guns; launched 1875. Lorna Doone; length, 103 ft. 4 in.; beam, 17 ft. 2 in.; tonnage, 118; 40 nom. H.P.; 2 guns; launched 1881.

Paddle steamer, Aden. Three armed launches (50 to 100 tons).

SIAM.—Unarmoured Ships.

Two corvettes (1000 tons, 8 guns); three gun-vessels; two gun-boats; yachts, and small craft.

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SPAIN.—Armoured Ships.

a.g.b., armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.s.*, coast-service vessel; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
b.	(1) **Pelayo** (building in France)	9990	344 6	65 7	17¾	19¼ turret	..	24 11	2	7000	2 32-c.m. (48-ton) B.L.R., 2 28-c.m. 38-ton B.L.R., 14 M.	6 tu.	bldng.	..	15·00	900	—
a.g.b.	**Duque de Tetuan** . (iron)	703	141 0	31 2	4	..	9	6 10	2	190	1 16-c.m. (Parrot), 4 bronze smooth-bores.	..	1874	..	..	23	—
br.	*Mendez Nunez* (wood)	3382	236 3	49 3	5	4½	20	21 11	1	500 (nom.)	4 9-in. M.L.R. (Armstrong), 2 8-in. do.	..	1861	..	8·00	400	—
„	**Numancia.** (iron)	7305	314 10	55 9	5½	5	12	25 3	1	3708	8 10-in. M.L.R. (Armstrong), 7 8-in. do., 8 l., 2 M.	..	1863	315,600	8·00	740	2450
c.s., t.	**Puig-cerda** (iron Monitor)	553	127 11	29 6	4	4	9	6 7	2	328	2 16-c.m. bronze smoothbores, 1 16-c.m. B.L.R. (Palliser).	..	1874	..	8·00	23	—
br.	*Sagunto* . (wood)	7352	292 0	55 10	6	6	24	30 1	1	3700	8 9-in. M.L.R. (Armstrong), 3 18-c.m. (Palliser), 8 l., 2 M.	..	1869	..	8·00	900	—
„	**Vitoria** . (iron)	7250	318 3	55 10	5½	5	12	25 3	1	4500	8 9-in. M.L.R. (Armstrong), 3 8-in. do., 6 l., 2 M.	..	1865	..	11·00	900	—
„	*Zaragoza* . (wood).	5620	278 10	55 10	5	..	26	24 7	1	3000	4 9-in. M.L.R. (Armstrong), 3 18-c.m. (Palliser), 8 16-c.m. do., 7 l., 2 M.	..	1867	..	8·00	700	—

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SPAIN.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *t.b.c.*, torpedo boat-catcher; P., deck protected throughout; *pp.*, partial deck protected.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
d.v.	Africa	629	157 5	23 3	wood	15 3	1	280	2 12-c.m. bronze smooth-bores	..	1862	..	7·00	120	—
c.r.	Alfonso XII.	8090	278 10	42 7	iron	16 5	1	4400	8 16-c.m. B.L.R. (Hontoria), 4 9-c.m. do., 2 l., 2 M.	..	bldng.	..	14·00	600	—
fr.cr.	Almanza	3960	275 7	49 3	wood	20 11	1	600 (nom.)	22 16-c.m. M.L.R. (Palliser), 6 l.	..	1864	..	7·00	650	—
g.v.	Animosa	510	150 11	26 3	iron	7 7	1	100 (nom.)	1 16-c.m. M.L.R. (Palliser), 1 12-c.m. bronze, smooth-bore, 2 l.	..	1860	..	5·00	—	—
cr.	Aragon	3342	246 0	45 11	wood	20 11	1	4400	8 16-c.m. B.L.R. (Hontoria), 2 8·7-c.m. do. (Krupp), 4 l., 2 M.	..	1879	..	14·00	470	—
g.v.	Bazan	757	164 0	24 7	iron	10 10	2	739	1 13-c.m. M.L.R. (Parrot), 1 12-c.m. bronze, smooth-bore.	..	1873	..	10·00	—	—
fr.cr.	Blanca	2452	209 11	42 7	wood	18 4	1	360 (nom.)	12 20-c.m. smooth-bores, 4 16-c.m. do., 4 l.	..	1859	..	7·00	300	—
g.v.	Caridad	370	147 7	22 7	wood	10 5	1	80 (nom.)	2 16-c.m. bronze smooth-bores	..	1860	..	6·00	—	—
fr.cr.	Cármen	3116	242 9	45 11	wood	19 7	1	600 (nom.)	16 20-c.m. smooth-bores, 4 16-c.m. do., 4 l.	..	1861	..	8·00	—	—
cr.	Castilla	3342	246 0	45 11	wood	20 11	1	4400	8 15-c.m. B.L.R. (Krupp), 4 9-c.m. do. (Hontoria), 2 l., 2 M.	..	1881	..	14·00	470	—
g.v.	Céres	415	144 4	22 7	wood	8 6	1	80 (nom.)	2 16-c.m. smooth-bores	..	1860	..	6·00	80	—
„	Concha	524	157 5	25 7	iron	8 7	2	600	3 12-c.m. B.L.R. (Hontoria), 2 M.	..	..	..	11·00	80	—
fr.cr.	Concepcion	3210	229 7	45 11	wood	20 1	1	2100	5 16-c.m. M.L.R., 16 20-c.m. smooth-bores, 4 l.	..	1860	..	8·00	360	—
g.v.	Concordia	553	157 5	23 11	wood	10 6	1	160	2 16-c.m. smooth-bores.	..	1857	..	6·00	100	—
corv.	Consuelo	605	180 5	28 3	wood	9 10	1	353	2 16-c.m. M.L.R. (Parrot), 1 12-cm. bronze, smooth-bore, 2 l.	..	1858	..	8·00	180	—
	Cristobel Colon Don Antonio Ulloa Don Juan de Austria	1130	210 0	32 0	iron	12 6	1	1600	3 6-in. B.L.R., 2 3-in. do.	..	bldng.	..	14·00	220	—
t.b.c.	Destructor	400	183 0	25 0	steel	13 0	2	4000	7 M.	..	bldng.	..	24·00	—	—
sl.	Don Juan de Austria	1152	209 11	32 2	iron	12 5	1	1500	5 12-c.m. B.L.R. (Hontoria), 2 l., ? M.	..	bldng.	..	14·00	220	—
g.v.	El Cano	524	157 5	25 7	iron	8 6	2	600	3 12-c.m. B.L.R. (Hontoria), 2 M.	..	1885	..	11·00	80	—

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d.v.	**Fernando el Catolico**	500	137	5	25	7	iron	8	5	2	550	1 16-c.m. M.L.R. (Palliser), 2 12-c.m. smooth-bores.	..	1875	..	10·00	20	—
g.v.	**General Lezo**	524	157	5	25	7	iron	8	6	2	600	3 12-c.m. R.L.R. (Hontoria), 2 M.	..	bldng.	..	11·00	80	—
jr.cr.	**Gerona**	3980	265	9	49	3	wood	20	8	1	600 (nom.)	21 smooth-bores, 2 l.	..	1864	..	9·00	675	—
g.v.	**Guadalquivir**	550	151	0	24	0	iron	8	6	1	120 (nom.)	2 4¾-in. M.L.R., 1 3¼-in. do.	..	1855	..	9·00	75	—
sl.	**Infanta Isabel**	1152	209	11	32	2	iron	12	5	1	1500	5 12-c.m. B.L.R. (Hontoria), 2 l., ? M.	..	1885	..	14·00	220	—
sl.	**Isabel II.**	1152	209	11	32	2	iron	12	5	2	1500	5 12-c.m, B.L.R. (Hontoria), 2 l.	..	1886	..	14·00	220	—
cr.	**Isla de Cuba** *pp.*	1030	185	0	30	0	steel	11	6	2	2200	6 4-¾in. B.L.R., 4 6-pdr. Q.F.	..	bldng.in Glasgow	..	15·00	160	—
cr.	Isla Filipinas *pp.*	1030	185	0	30	0	steel	11	6	2	2200	6 4¾-in. B.L.R., 4 6-pdr. Q.F.	..		..	15·00	160	—
„	Jorge Juan.	935	203	5	29	6	wood	12	2	1	1100	3 16-c.m. M.L.R. (Palliser), 2 l.	..	1876	..	13·00	130	—
fr.cr.	Lealtad	3075	223	2	42	7	wood	20	4	1	1449	33 guns, 5 l., 4 M.	..	1860	..	9·00	350	—
g.v.	Ligera	445	147	7	23	7	wood	8	10	1	393	2 16-c.m. M.L.R., 1 12-c.m. smooth-bore, 1 l.	..	1864	..	7·00	180	—
„	Magellanes	524	157	5	25	7	iron	8	6	2	600	3 12-c.m. B.L.R. (Hontoria), 2 M.	..	bldng.	..	11·00	80	—
corv.	Maria de Molina	1677	203	5	36	0	wood	16	9	1	435	10 16-c.m. M.L.R. (Palliser), 4 l.	..	1868	..	7·00	330	—
d.v.	Marques del Duero	500	157	5	25	7	iron	8	5	2	550	1 16-c.m. M.L.R. (Palliser), 2 12-c.m. smooth-bores.	..	1875	..	10·00	90	—
cr.	**Navarra**	3342	232	11	42	7	wood	20	4	1	4400	8 16-c.m. B.L.R. (Hontoria), 2 8·7-c.m. do. (Krupp), 4 l., 2 M.	..	1881	..	14·00	470	—
fr.cr.	**Navas de Tolosa**	4460	265	9	49	3	wood	22	4	1	600 (nom.)	22 16-c.m. M.L.R. (Palliser), 4 16-c.m. smooth-bores, 4 l.	..	1865	..	7·00	670	—
g.v.	**Prosperidad**	420	141	0	22	7	wood	9	7	1	134	2 16-c.m. smooth-bores, 1 l.	..	1865	..	6·00	80	—
cr.	**Reina Christina**	3090	278	10	42	7	iron	16	5	1	4400	8 16-c.m. B.L.R. (Hontoria), 4 9-c.m. do., 2 l., 2 M.	..	bldng.	..	14·00	600	—
cr.	**Reina Mercedes**	3090	278	10	42	7	iron	16	5	1	4460	8 16-c.m. B.L.R. (Hontoria), 4 9-c.m. do., 2 l., 2 M.	..	bldng.	..	14·00	600	—
„	**Reina Regenta** P.	4300	318	6	50	0	steel	20	5	2	11,000	4 8-in. B.L.R., 6 4¾-in. do.	..	..	..	19·00	1100	—
sl.	**Sanchez Barcaistegui**	935	203	5	29	6	wood	12	2	1	1100	3 16-c.m. M.L.R. (Palliser), 2 l.	..	1876	..	13·00	130	—
d.v.	**San Quentin**	1300	246	0	32	10	iron	11	6	1	1500	3 12-c.m. B.L.R. (Hontoria), 2 l., 1 M.	..	1856	..	10·00	360	—
g.v.	**Santo Filomena**	510	150	1	26	3	iron	7	7	1	420	1 16-c.m. M.L.R. (Palliser), 1 12-c.m., smooth-bore, 1 l.	..	1859	..	10·00	130	—
„	**Sirena**	445	147	7	22	11	wood	9	6	1	227	1 16-c.m. M.L.R. (Palliser), 2 12-c.m. smooth-bore, 2 l.	..	1863	..	8 00	95	—
corv.	**Tornado**	2090	219	10	32	10	composite	14	5	1	328 (nom.)	2 16-c.m. M.L.R. (Palliser), 2 12-c.m. smooth-bores, 2 l.	..	1866	..	9·00	350	—
g.v.	**Valiente**	733	150	1	25	11	iron	7	10	1	100 (nom.)	1 16-c.m. M.L.R. (Palliser), 1 12-c.m. smooth-bores, 2 l.	..	1860	..	5·00	130	—
sl.	**Velasco**	1152	209	11	29	3	iron	12	5	1	1500	3 15-c.m. B.L.R. (Armstrong), 2 l., 1 M.	..	1881	..	14·30	220	—
„	**Vencedora**	778	177	2	26	3	wood	12	5	1	200	2 16-c.m. smooth-bores, 1 12-c.m. do., 2 l.	..	1861	..	8·00	210	—
g.v.	**Vulcano**	530	164	0	28	3	iron	9	2	1	200 (nom.)	2 16-c.m. smooth-bores, 1 l.	..	1845	..	9·00	120	—

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NOTES ON THE SPANISH NAVY.

Armoured and Unarmoured Ships.

Besides paddle corvettes, gun-vessels, training ships and transports, there are on the Spanish lists :—

Gunboats.—Alsedo, Cocodrillo, Cuba Española, Eulalia, Ferrolano, Gaditano, Laborde, Paz, Pelicano, Pilar, Salamandra (216 to 242 tons), 199 to 240 I.H.P.).

Small steamers, classed as third class gunboats, forty three (33 to 179 tons).

Four torpedo despatch vessels and one torpedo boat-chaser are being built, also twelve first-class torpedo boats.

Torpedo boats.—Six (85 tons; 19 knots); one for Whitehead torpedoes, three for Spar torpedoes.

(1) The armour-clad marked N (Pelayo) in the Table is being built in France for the Spanish Government. She will apparently resemble in general design the French barbette ships of the Marceau type, but she is to have four barbette turrets, one forward, one aft, and one on each side. She will have two masts, each with two armed tops.

Five rapid cruizers are being built for the Spanish Navy, and three third-class cruisers, Cristobel Colon, Don Antonio Ulloa, and Isabel II., two despatch vessels, and four gun-vessels, for the Philippine Islands.

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SWEDEN.—Armoured Ships.

a.g.b., armoured gunboat; *c.s.*, coast-service vessel; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Turret.	Water-line.					Guns.	Tor-pedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
a.g.b.	**Berserk** . (iron)	452	131 3	29 6	14	2½	34	8 3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1874	..	8·00	19	—
„	**Bjorn** . . .	457	131 3	26 3	14	2½	34	8 3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1874	..	8·00	19	—
„	**Fenris** . . .	259	104 11	22 4	11	1	34	7 10	1	44	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1872	..	6·00	7	—
„	**Folke** . . .	460	131 3	26 3	14	2½	34	8 3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1875	..	8·00	19	—
„	**Garmer** . . .	268	91 10	22 11	6	3	8	7 7	1	90	1 27-c.m. B.L.R., 2 M. . . .	..	1868	..	6·00	—	—
„	**Gerda** . . .	457	131 3	26 3	14	2½	34	8 3	2	133	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1873	..	8·00	19	—
„	**Hildur** . . .	457	131 3	26 3	14	2½	34	8 3	2	133	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1872	..	8·00	19	—
c.s., t.	**John Ericsson**. .	1500	200 2	45 11	11	4½	31½	11 6	1	380	2 24-c.m. B.L.R., 2 M. . . .	..	1865	..	6·00	112	—
„	**Loke** . (iron)	1600	205 3	45 11	18	4	40	11 10	1	430	2 24-c.m. B.L.R., 3 M. . . .	..	1871	..	7·00	112	—
a g.b.	**Skold** . . .	247	104 11	22 4	9	1	33⅞	8 3	1	17	1 24-c.m. B.L.R., 2 M. . . .	..	1869	..	4·00	5	—
„	**Solve** . . .	454	131 3	29 6	14	2	34	8 3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1875	..	8·00	19	—
t.	**Svea** (1) . (steel)	2900	249 4	49 3	11½	11½	11½	15 9	2	3100	2 10-in. 27-ton B.L.R. (Armstrong), 3 6-in. do., 6 M.	1 tu.	..	127,300	14·00	200	800 at 12 knots.
c.s., t.	**Thordon** . . .	1500	200 2	45 11	11	4½	26	11 6	1	380	2 24-c.m. 15-ton B.L.R., 2 M. . .	..	1866	..	6·00	112	—
„	**Tirfing** . . .	1500	200 2	45 11	11	4½	26	11 6	1	380	2 24-c.m. 15-ton B.L.R., 2 M. . .	..	1867	..	6·00	112	—
a.g.b.	**Ulf**	457	131 3	26 3	14	2	34	8 3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1873	18,000	8·00	20	—

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SWEDEN.—Unarmoured Ships.

corv., corvette; *fr. cr.*, frigate-built cruiser; *g.v.* gun-vessel; *tor. ship*, torpedo ship.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
corv.	Balder	1886	203 5	36 0	wood	18 4	1	1380	4 15-c.m. B.L.R. (Armstrong), 2 12-c.m. B.L.R., 1 l., 6 M.	..	1870	..	12·00	200	940
g.v.	Blenda	500	167 4	25 11	iron	9 2	2	590	1 27-c.m. 24-ton B.L.R. (Armstrong), 1 12-c.m. B.L.R., 2 M.	..	1875	..	12·00	98	—
„	Disa	500	167 4	25 11	„	9 2	2	590	1 27-c.m. 24-ton B.L.R. (Armstrong), 1 12-c.m. B.L.R., 2 M.	..	1877	..	12·00	98	—
tor. ship.	Drott (was Ran)	630	173 10	26 3	„	9 6	2	960	4 Engström, Q.F.	tu.	1877	..	13·00	100	1000
g.v.	Edda	640	180 5	27 3	„	9 6	2	960	1 27·4-c.m. 27-ton B.L.R., 1 15-c.m., do. 4 M.	..	1882	..	13·00	80	—
corv.	Freja	2000	216 6	39 4	steel&wood	18 9	1	1750	4 15-c.m., 8 12-c. m. B.L.R., 8 M.	..	1885	..	12·00	180	—
g.v.	Rota	537	170 7	26 3	iron	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1878	..	13·00	80	—
corv.	Saga	1535	200 2	32 10	wood	17 1	1	900	1 15-c.m. B.L.R. (Armstrong), 6 12-c.m. B.L.R., 2 l., 4 M.	..	1878	..	11·00	170	—
g.v.	Skaggald	537	170 7	26 3	iron	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1879	..	13·00	80	—
„	Skagul	537	170 7	26 3	„	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1878	..	13·00	80	—
„	Skuld	537	170 7	26 3	„	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1880	..	13·00	80	—
„	Urd	537	170 7	26 3	„	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1877	..	13·00	80	—
fr. cr.	Vanadis	2136	209 11	42 7	wood	20 1	1	1400	8 17-c.m. B.L.R., 8 16-c.m. shell guns, 4 M.	..	1862	..	11·00	235	—
g.v.	Verdande	537	170 7	26 3	iron	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1879	..	13·00	80	—

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Gunboats.—Alfhild, Aslög, Astrid, Gunhild, Hagland, Ingegerd, Motala, Sigrid (180 to 195 tons; 130 I.H.P.).

Torpedo boats.—Four of large class for Whitehead torpedoes, two for spar torpedoes completed, and four are building.

The Swedish Navy has also training ships, transports, surveying vessels, and steamers of old construction.

NOTES ON THE SWEDISH NAVY.

(1) The Svea is, apparently, built in accordance with the proposal of the Swedish Commission appointed to consider the best types of ships for the Navy, for an armour-clad designated "Type A." The latter was to carry two 10-in. B.L.R. (Armstrong) guns in a turret, one 6-inch gun astern, and one on each broadside, also machine guns and one torpedo tube. The Svea.

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NORWAY.—Armoured Ships.

c.s.,t., coast-service turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Turret.	Belt.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.s., t.	**Mjolner** .	1515	203 5	45 11	12	5	39	11 10	1	450	2 27-c.m. 18-ton M.L.R. (Armstrong), 1 l., 1 M.	..	1868	66,800	8·00	138	—
,,	**Skorpionen**	1447	200 2	45 11	12	5	39	11 6	1	350	2 27-c.m. 18-ton M.L.R. (Armstrong), 1 l., 1 M.	..	1866	..	6·00	138	—
,,	**Thor** . .	2003	203 5	49 3	14¼	7	38	13 2	1	600	2 27-c.m. 20-ton M.L.R. (Armstrong), 1 l., 1 M.	..	1872	..	8·00	200	—
,,	**Thrudvang.**	1515	200 2	45 11	12	5	39	11 10	1	500	2 27-c.m. 18-ton M.L.R. (Armstrong), 1 l., 1 M.	..	1867	..	8·00	138	—

NORWAY.—Unarmoured Ships.

corv., corvette; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	tons.	tons.	knots.
g.v.	**Ellida**	1000	187 0	32 8	wood	14 4	2	900	5 15-c.m. Krupp, 1 12-c.m. do., 1 l., 2 M. .	..	1880	..	12·00	97	—
fr.cr.	**Kong Sverre** . .	3472	252 7	49 3	wood	22 4	1	1800	2 20-c.m. M.L.R. (Armstrong), 4 17-c.m. M.L.R., 16 16-c.m. do., 22 8-in. smooth-bore, 6 l.	..	1860	..	11·00	377	—
									4 16-c.m. M.L.R., 10 8-in. smooth-bore, 3 l. .	..	1862	..	10·00	195	—
corv.	**Nord Stjernen** . .	1609	216 6	39 4	,,	17 9	1	800	4 16-c.m. M.L.R., 10 8-in. smooth-bore, 3 l. .	..	1855	..	7·00	54	—
sl.	**Nornen** . . .	958	173 10	36 0	,,	15 9	1	280	1 20-c.m. 7-ton M.L.R. (Armstrong), 1 17-c.m. 5-ton M.L.R., 12 16-c.m. do., 20 8-in. smooth-bores, 4 l.	..	1856	..	10·00	200	—
fr.cr.	**St. Olaf.** . . .	2182	229 7	42 7	,,	18 9	1	1200							
g.v.	**Sleipner** . . .	580	173 10	25 11	iron	9 6	2	800	1 26-c.m. 22-ton B.L.R., 1 15-c.m. do. (Krupp), 1 M.	..	1877	..	12·00	80	—

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NOTES ON THE NORWEGIAN NAVY.[1]

Eleven *Gunboats.*—Brage, Glommen, Gor, Lougen, Nor, Riukan, Sarpen, Tyr (building), Uller, Vale, Vidar (189 to 280 tons; 100 to 450 I.H.P.).

Smaller gunboats.—Aasgardsrand, Arendal, Brevig, Dverg, Horten Karmo, Kongsberg, Kristiansand, Langesund, Laurvig, Lillesand, Nök, Porsgrund, Skien, Skudernoes, Tönsberg (55 tons, 70 I.H.P.); each armed with 1 5½-inch gun. Trold (97 tons; 65 I.H.P.).

Torpedo boats.—Six first-class; one second-class.

Paddle steamer, transport, training ships.

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TURKEY.—Armoured Ships.

a.g.b., armoured gunboat; *br.*, broadside ship; *c.b.*, central-battery ship; t., turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Turret or Battery.	Belt.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.b.	**Assar-i-Schefket** . .	2080	203 5	42 7	4½	6	9	16 5	2	1750	5 8-in. M.L.R. (Armstrong), 2 M. . .	..	1868	..	11·00	300	—
,,	**Assar-i-Tevfik** . .	4687	272 4	52 6	6	8	9	24 11	1	3560	8 9-in. 12-ton M.L.R. (Armstrong), 2 M. .	..	1868	..	13·00	400	—
,,	**Avni-Illah**	2400	226 4	36 0	5	6	10	16 5	2	2200	4 9-in. M.L.R. (Armstrong), 2 M. . .	..	1869	..	12·00	220	—
br.	**Azazieh**	6400	292 0	55 9	5	5¼	9	25 7	1	3735	1 9-in. 12-ton M.L.R. (Armstrong), 17 8-in. do., 2 M.	..	1864	..	13·00	750	—
c.b.	**Feth-i-Bulend** . . .	2806	236 3	39 4	6	9	10	18 1	1	3250	4 9-in. M.L.R. (Armstrong), 1 7-in. do., 2 M.	..	1869	..	13·00	300	—
a.g.b.	**Feth-el-Islam** . . .	335	101 9	24 7	3	3	10	5 11	1	290	2 4-in. guns.	..	1864	..	8·00	20	—
c.b.	**Hamidieh**	6700	292 0	55 9	5	9	18	24 10	1	6000	10 24-c.m. B.L.R. (Krupp), 2 17 c.m., do., 6 l., 2 M.	..	1885	..	12·00	600	—
a.g.b.	**Hisber** (was Nusritieh) . .	404	144 4	30 10	3	3	5½	5 7	1	400	2 12-c.m. B.L.R. (Krupp) . . .	..	1875	..	7·00	20	—
t.	**Hufzi-el-Rahman** . .	2540	204 0	45 11	5	4½	10	14 5	1	200 nom.	2 9-in. M.L.R. (Armstrong), 2 7-in. do., 1 5-in., 2 M.	..	1868	..	12·00	200	—
c.b.	**Idjilalieh**	2266	213 3	42 7	4·5	6	13	17 4	1	1800	2 9-in. M.L.R. (Armstrong), 3 7-in., 2 M.	..	1870	..	11·00	300	—
br.	**Mahmudieh** . . .	6400	292 0	55 9	5	5¼	9	25 7	1	3735	1 9-in, M.L.R. (Armstrong), 17 8-in. do., 2 M.	..	1864	..	12·00	750	—
c.b.	**Mesoodieh**	9120	331 5	59 0	10	12	10	25 11	1	7431	12 10-in. (18 ton) M.L.R. (Armstrong), 3 7-in. do., 6 l., 2 M.	..	1874	..	13·00	600	—
,,	**Muin-i-Zaffer** . . .	2400	230 0	36 0	5	6	10	16 5	2	2200	4 9-in. M.L.R. (Armstrong), 2 M. . .	..	1869	..	12·00	220	—
c.b.	**Mukadim-i-Hair** . .	2806	236 3	39 4	6	9	10	18 1	1	3000	4 9-in. M.L.R. (Armstrong), 17-in. do., 2 M.	..	1872	..	12·00	300	—
c.b.	**Nedjim-i-Schefket** . .	2080	203 5	42 7	4¼	6	9	16 5	2	1900	5 8-in. M.L.R. (Armstrong), 2 M. . .	..	1868	..	11·00	300	—
b.r.	**Orkanieh**	6400	292 0	55 9	5	5¼	9	25 7	1	3735	1 9-in. M.L.R. (Armstrong), 17 8-in. do., 2 M.	..	1865	..	12·00	750	—
,,	**Osmanieh**	6400	292 0	55 9	5	5¼	9	25 7	1	3735	1 9-in. M.L.R. (Armstrong), 17 8-in. do., 2 M.	..	1864	..	12·00	750	—
a.g.b.	**Semendrieh** . . .	335	101 9	24 7	3	3	10	5 11	1	290	2 4-in. guns.	..	1864	..	8·00	20	—

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TURKEY.—Unarmoured Ships.

fr.cr., frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; *t.g.*, torpedo gunboat.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean Draught of Water.	Propeller.	Nominal Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
g.v.	**Beyruth**	609	173 6	26 7	..	12 10	1	160	1 6-in. B.L.R., 14¾-in. do., 6 40-pdr.	..	1863	—	—	—	—
sl.	**Brussa**	800	172 6	30 6	..	15 2	1	150	2 6-in. B.L.R., 8 4¾-in. do.	..	1859	..	11·00	120	—
„	**Edirneh**	782	172 6	30 6	..	14 2	1	150	2 6-in. B.L.R., 10 4¾-in. do.	..	1859	..	11·00	120	—
fr.cr.	**Ertogrul**	2344	250 0	49 10	..	23 7	1	600	21 6-in. B.LR., 20 4¾-in. do.	..	1863	..	10·00	350	—
gv.	**Iskenderieh**	609	173 6	26 7	..	12 10	1	160	1 6-in. B.L.R., 1 43-in. do., and 6 40-pdr.	..	1863	..	11·00	120	—
sl.	**Mansurah**	800	174 10	30 6	..	15 2	1	150	2 6-in. B.L.R., 8 7¾-in. do.	..	1863	..	11·00	120	—
„	**Mehemet Selim**	1300	196 10	32 10	..	16 6	1	450	21 6-in. R.L.R.	..	1875	..	11·00	250	—
g.v.	**Mehrieh**	609	173 6	26 7	..	12 10	1	160	2 4¾-in. B.L.R.	..	1863	..	10·00	120	—
fr.cr.	**Much bir-i-Surur** (Torp. Sch.)	1477	209 11	38 0	..	17 5	1	450	22 guns	..	1879	..	—	—	—
sl.	**Muzafer**	800	174 10	30 6	..	15 2	1	150	2 6-in. B.L.R., 10 4¾-in. do.	..	1863	..	12·00	150	—
„	**Sedul Bahr**	609	173 6	26 7	..	12 10	1	160	2 4¾-in. B.L.R.	..	1859	..	10·00	120	—
fr.cr.	**Selimieh**	4717	279 10	59 0	..	23 7	1	600	25 6-in. B.L.R., 24 4¾-in. do.	..	1865	..	10·00	350	—
s.l.	**Sinope**	800	172 0	30 6	wood	15 0	1	150	1 6-in. B.L.R., 8 4¾-in. do.	..	1859	..	10·00	120	—
t.g.	Not named	260	200 0	20 3	steel	8 0	2	2700*	1 4-in. B.L.R., 6 M.	..	bldg.	..	21·00	—	—
g.v.	**Uthared**	609	173 6	26 7	..	12 10	1	160	2 4¾-in. R.L.R.	..	1863	..	10·00	120	—
„	**Zuhaf**	609	173 6	26 7	..	12 10	1	160	2 4¾-in. B.L.R.	..	1862	..	10·00	120	—
sl.	Not named	1960	226 0	37 0	composite	14 0	1	2000*	1 6-in. B.L.R., 4 4¾-in. do.	..	bldg.	..	14·00	—	—
sl.	Not named	1160	210 0	35 0	composite	14 0	1	1800*	1 6-in. B.L.R., 4 4¾-in. do.	..	bldg.	..	14·00	—	—

* Indicated.

27 *Despatch Vessels and Yachts.*—Ainaly-Kawak, Arcadia, Candia, Chania, Esser-i-Djidid, Esser-i-Neiseret, Faiz-i-Bahri, Fevaid, Iksan, Ismail, Izzedin, Moodar-i-Zaffer, Monassir Noodoosche-i-Reisan, Peih-i-Tidjaret, Rethimo, Rhodos, Sahir, Seyar, Seyar-i-Derja Soolhie, Stamboul, Stankio, Sultanieh, Surreya, Syrat, Thalia of 184 tons to 1448 tons displacement, and 50 H.P. to 800 H.P.

4 *Gunboats.*—Akha, Frat, Shefket Numa, and Sholt of 200 tons displacement, and 60 H.P.

Torpedo boats.—18 first-class torpedo boats built and building, six of 88 tons, and 20 knots speed.

There are also on the list of ships screw and paddle transports and store ships, harbour ships and vessels, tugs, &c.

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UNITED STATES.—Armoured Ships (1).

c.s., t., coast-service turret ship; *to. ram*, torpedo ram.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Turret or Battery.					Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.s., t.	**Ajax** (1 turret) (iron).	2100	226 4	42 7	5	11	..	13 9	2	320	2 15-in. smooth-bores . .	..	1864	..	6·00	160	—
to. ram	**Alarm** (iron) . .	720	172 6	29 3	4 (on traverse)	..	16	11 2	1	800	1 15-in. smooth-bore . .	..	1873	..	11·00	—	—
c.s., t.	**Amphitrite** (2 t.) . (iron)	3815	249 4	55 9	7	14	..	14 3	2	1600	4 10½ B.L.R. (new steel), 8 M. .	..	1883 (rebuilt)	..	10·00	300	1800
,,	**Camanche** (1 t.) (iron)	1875	200 2	45 11	5	11	..	11 6	2	350	2 11-in. smooth-bores . .	..	1863	..	6·00	160	—
,,	**Canonicus** (1 t.) (iron)	2100	226 4	42 7	5	11	..	13 9	2	320	2 15-in. smooth-bores . .	..	1864	..	6·00	160	—
,,	**Catskill** (1 t.) (iron) .	1875	200 2	45 11	5	11	..	11 6	2	350	2 11-in. smooth-bores . .	..	1863	..	6·00	150	—
to. ram	**Intrepid** (iron) . .	1123	170 7	36 0	5	..	13⅞	11 10	2	800	.. ..	..	1874	..	9·00	—	—
c.s., t.	**Jason** (1 t.) (iron) .	1875	200 2	45 11	5	11	..	13 6	2	350	2 11-in. smooth-bores . .	..	1864	..	6·00	150	—
,,	**Lehigh** (1 t.) (iron) .	1875	200 2	45 11	5	11	..	13 6	2	350	2 11-in. smooth-bores . .	..	1864	..	6·00	150	—
,,	**Mahopac** (1 t.) (iron)	2100	226 4	42 7	5	11	..	13 9	2	320	2 15-in. smooth-bores . .	..	1865	..	6·00	160	—
,,	**Manhattan** (1 t.) (iron)	2100	226 4	42 7	5	11	..	13 9	2	320	2 15-in. smooth-bores . .	..	1865	..	6·00	160	—
,,	**Miantonomoh** (2 t.). (iron)	3815	249 4	55 9	7	14	8	14 3	2	1600	4 10½-in B.L.R. (new steel), 8 M.	..	1883 (rebuilt)	272,000	10·00	330	1800
,,	**Monadnock** (2 t.) . (iron)	3815	249 4	55 9	7	14	8	..	2	1600	4 10½-in. B.L.R. (new steel), 8 M.	..	1883 (rebuilt)	272,000	10·00	330	1800
,,	**Montauk** (1 t.) (iron)	1875	200 2	45 11	5	11	..	11 6	2	350	2 11-in. smooth bores . .	..	1864	..	4·00	160	—
,,	**Nahant** (1 t.) (iron) .	1875	200 2	45 11	5	11	..	11 6	2	350	2 11-in. smooth-bores . .	..	1863	..	6·00	160	—
,,	**Nantucket** (1 t.) (iron)	1875	200 2	45 11	5	11	..	11 6	2	350	2 11-in. smooth-bores . .	..	1863	..	5·00	160	—
,,	**Passaic** (1 t.) (iron) .	1875	200 2	45 11	5	11	..	11 6	2	350	2 11-in. smooth-bores . .	..	1863	..	6·00	160	—
,,	**Puritan** . . .	6000	278 10	59 0	7	12	..	18 1	2	3700	4 10½-in. B.L.R. (new steel), 8 M.	..	1883 (rebuilt)	..	13·00	580	—
,,	**Saugus** (1 t.) (iron) .	2100	226 4	42 7	5	11	..	13 9	2	320	2 15-in. smooth-bores . .	..	1864	..	6·00	160	—
,,	**Terror** . . .	3815	249 4	55 9	7	14	8	14 3	2	1600	4 10½-in. B.L.R. (new steel), 8 M.	..	1883 (rebuilt)	206,800	..	330	1800
,,	**Wyandotte** (iron) .	2100	225 0	43 7	5	10	..	13 6	1	320	2 15-in. (9-ton) M.L.R. . .	..	1864	..	6·00	160	—

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NOTES ON THE UNITED STATES NAVY—ARMOURED SHIPS.

(1) The following will give an idea of the principles followed in rebuilding some of the double-turreted monitors. For a length of 218 feet the side armour is carried down to a depth of 3·6 inches below the water line, at a thickness of 11 inches, and thence to the lower edge, with a thickness diminishing to 6 inches. At the extremities the armour is 10 inches thick forward and 7 inches thick aft. From the rudder-post to the aftermost water-tight bulkhead the vessel is protected by a one-inch steel deck. The 10½-inch breech-loading guns are mounted in two turrets, having an internal diameter of 22 feet. The turret armour is 14 inches thick, and 7·2 inches in depth. In the vicinity of the ports the armour is increased to 16 inches. The internal wooden backing is 11 inches in thickness. The double plating inside the armour consists of two thicknesses of 1½-inch steel plate. A light shield is built for each turret, and above the foremost turret is the chart-house. The ventilating shafts and the funnel are armoured. The armour of the latter extends to 9 feet 6 inches above the deck, and is 4½ inches in thickness. The guns will be worked with hydraulic power. The minor armament will include four 2-inch Hotchkiss and four Gatling guns. The ship will carry two electric lights, and will have a complete outfit of torpedo gear.

It has been reported that a large sea-going armoured central battery ship of 6200 tons displacement, 8500 indicated horse-power, speed 17½ knots, has been laid down at Brooklyn, with 9-inch compound armour and 2½-inch deck and a principal armament of four 25-ton B.L.R. guns. This report is not confirmed.

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UNITED STATES.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; *p.p.*, partial deck protected.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
sl.	**Adams** . . .	1375	183 9	36 0	wood	14 2	1	800	1 8-in. 8-ton smooth-bore, 4 9-in. do., 1 60-pdr. M.L.R.	..	1874	..	8 00	140	—
g.v.	**Alert** . . .	1020	173 10	31 10	iron	13 0	1	656	1 8-in. smooth-bore, 2 9-in. do., 1 60-pdr. M.L.R.	..	1874	..	8·00	140	—
sl.	**Alliance** . . .	1375	183 9	36 0	wood	14 2	1	774	1 8-in. smooth-bore, 4 9-in. do., 1 60-pdr. M.L.R.	..	1875	..	8·00	130	—
cr.	**Atlanta** (1) *p.p.* . .	3000	270 0	42 0	steel	16 5	1	3500	2 8-in. B.L.R., 6 6-in. do., 8 M. . .	..	1884	123,600	15·00	780	4000
„	**Boston** (1) *p.p.* . .	3000	270 0	42 0	„	16 5	1	3500	2 8-in. B.L.R., 6 6-in. do., 8 M. . .	..	1884	123,600	15·00	780	4000
fr. cr.	**Brooklyn** . . .	3000	232 11	42 7	wood	19 4	1	1165	16 9-in. smooth-bores, 2 100-pdr. do. .	..	1858	..	7 00	275	—
„	**Chicago** (2) *p.p.* .	4500	325 0 on water line.	48 2	steel	19 0	2	5000	4 8-in. B.L.R., 8 6-in. do., 2 5-in. do., 6 M.	..	bldng.	177,800	14·00	940	—
d.v.	**Dolphin** . . .	1485	239 6	31 10	„	14 2	1	2300	1 6-in. 5-ton B.L.R., 4 M. . . .	..	1884	61,000	13·00	310	—
sl.	**Enterprise** . .	1375	183 9	36 0	wood	14 2	1	800	1 8-in. smooth-bore, 4 9-in. do., 1 60-pdr. do. M.L.R.	..	1874	..	8·00	140	—
„	**Essex**	1375	183 9	36 0	„	14 2	1	800	1 8-in. smooth-bore, 4 9-in. do., 1 60-pdr. M.L.R.	..	1874	..	8·00	140	—
corv.	**Galena** . . .	1900	216 6	36 0	„	16 5	1	940	1 8-in. B.L.R., 6 9-in. smooth-bores . .	..	1877	..	7·00	125	—
fr. cr.	**Hartford** . . .	2900	226 4	42 7	„	18 4	1	696	12 9-in. smooth-bores, 1 8-in. do., 2 l., 4 M.	..	1858	..	7·00	241	—
corv.	**Iroquois** . . .	1575	200 2	32 10	„	15 1	1	813	2 11-in. smooth-bores, 4 9-in. do., 1 60-pdr. M.L.R.	..	1858	..	8·00	128	—
„	**Juniata** . . .	1900	203 5	39 4	„	16 5	1	1304	1 8-in. smooth-bore, 4 9-in. do., 1 60-pdr.	..	1862	..	8·00	235	—
„	**Kearsarge** . . .	1550	196 10	32 10	„	15 9	1	822	2 8-in. smooth-bores, 4 9-in. do., 1 60-pdr. M.L.R.	..	1861	..	8·00	165	—
fr. cr.	**Lancaster** . . .	3250	236 3	45 11	„	19 1	1	2000	16 9-in. smooth-bores, 2 100-pdr. do. .	..	1859	..	8·00	288	—
corv.	**Marion** . . .	1900	216 6	37 0	„	16 5	1	1172	6 9-in. smooth-bores, 1 8-in. B.L.R. . .	..	1873	..	9·00	156	—

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„	Mohican	1900	216	6	36	0	„	16	5	1	1172	6 9-in. smooth-bores, 1 8-in. B.L.R.	..	1882	..	12·00	—	—
fr. cr.	New York	4527	314	11	45	11	„	..	..	..	..	.. ..	..	Building since 1865		—	—	—
sl.	Nipsic	1373	183	9	36	0	„	14	2	1	1375	6 9-in. smooth-bores, 1 8-in. do., 1 60-pdr. M.L.R.	..	1878	..	7·00	—	—
fr. cr.	Omaha	2400	249	4	39	4	„	16	5	1	1150	10 9-in. smooth-bores, 1 8-in. do., 1 60-pdr. M.L.R.	..	1868	..	12·00	—	—
corv.	Ossipee	1900	203	5	39	4	„	16	5	1	1304	1 11-in. smooth-bore, 6 9-in do.	..	1861	..	7·00	—	—
fr. cr.	Pensacola	3000	229	7	42	7	„	18	9	1	1165	2 11-in. smooth-bore, 18 9-in. do., 2 60-pdr. M.L.R.	..	1859	..	6·00	—	—
corv.	Quinnebaug	1900	216	6	36	0	„	16	5	1	1103	6 9-in. smooth-bores, 1 8-in. B.L.R.	..	1875	..	9·00	—	—
g.v.	Ranger	1020	173	10	31	10	iron	12	10	1	656	1 11-in. smooth-bore, 2 9-in. do., 1 60-pdr. M.L.R.	..	1874	..	6·00	—	—
fr. cr.	Richmond	2700	226	4	42	7	wood	17	4	1	1078	12 9-in. smooth-bore, 1 8-in. do., 1 60-pdr. M.L.R.	..	1860	..	7·00	—	—
„	Shenandoah	2100	236	3	39	4	„	16	5	1	1304	6 9-in. smooth-bores, 2 8-in. do., 1 60-pdr. M.L.R.	..	1863	..	6·00	—	—
corv.	Swatara	1900	216	6	36	0	„	16	5	1	1176	6 9-in. smooth-bores, 1 8-in. B.L.R.	..	1873	..	8·00	—	—
„	Tennessee	4840	335	0	45	2	„	21	7	1	1900	2 8-in. M.L.R., 4·80 pr. Q.L., 16 9-inch M.L.	..	1865	..	12·00	420	—
fr. cr.	Trenton	3900	252	7	49	3	wood & iron	20	4	1.	3100	11 8-in. M.L.R. (Pallisser's), 6 l.	..	1875	..	14·00	—	—
corv.	Vandalia	2100	216	6	39	4	„	17	4	1	1176	6 9-in. smooth-bores, 1 8-in. B.L.R.	..	1874	98,726	7·00	—	—
g.v.	Yantic	900	180	5	29	6	„	12	2	1	670	1 11-in. smooth-bore, 2 9-in. do., 1 60-pdr. M.L.R.	..	1878	..	8·00	—	—

Two cruisers from 3000 to 5000 tons, one of 1600 tons, and one of 800 are about to be built.

Paddle steamers.—Michigan (685 tons), Monocacy (1370 tons), Powhattan (3980 tons), Tallapoosa (1270 tons).

Steamers (Fourth Rate), Despatch (560 tons, 402 I.H.P.); Palos (420 tons); Fortune, Leyden, Mayflower, Nina, Pinta, Speedwell, Standish, Triana (each 306 tons); Catalpa (191 tons), Cohasset (100 tons), and Rescue (111 tons).

Torpedo boats.—Two 128 feet long, and one 108 feet.

Surveying ships, training ships, store ships, are not included in the above lists.

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NOTES ON THE UNITED STATES NAVY—UNARMOURED SHIPS.

DETAILS OF CONSTRUCTION.

The Boston and Atlanta.

(1) The hulls of the Boston and Atlanta are of steel, and have eight complete transverse bulkheads extending to the main deck, dividing the vessel into nine main water-tight compartments. The machinery spaces, extending over a length of 100 feet, are enclosed by a protective deck 1½ inch thick. An inner bottom extends throughout the length of the machinery spaces, forming a water-tight double bottom containing twelve water-tight cells. Longitudinal bulkheads extend on each side throughout the machinery spaces, forming side coal bunkers, and affording a coal armour of about 8 feet thick above the water-line, and an average thickness of about 5 feet below it. Altogether the Boston is divided into 73 water-tight compartments.

The guns are mounted so as to command a very extensive train or sweep of the horizon. In vessels of this class it is usual to have an open-deck battery and a poop and topgallant forecastle, but these have been moved to the centre of the vessel, leaving the extremities unobstructed. Outside the forward port angle and the after starboard angle of the superstructure an 8-inch long-rifled gun will be mounted in a barbette about 3 feet high, built of 2-inch steel plates. The forward gun has a train from 40° abaft the beam, on the port side sweeping the whole deck forward to 30° abaft the beam on the starboard side, the after gun having a similar range. Within the superstructure six 6-inch breech-loading rifles are mounted; two on each broadside, with a train of 60° before and abaft the beam; one forward in the starboard angle of the superstructure may fight either through a forward or a broadside port, giving a total train of from 20° across the bow to 60° abaft the beam. The remaining gun is similarly mounted on the port side aft.

There is one steel four-bladed screw. The boilers are also of steel, return-tubular and eight in number.

The Chicago.

(2) The Chicago is a protected steam cruiser, built of mild steel throughout and without wood sheathing. The battery consists of four 8-inch breech-loaders, weighing about 12 tons each, mounted in projecting half-turrets on the flush spar deck, the centre of the trunnions being 20·25 feet above water. The turrets are unarmoured,

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and the guns fight in large open ports. The only protection for the men is afforded by shields on the guns. The train of the forward guns will be 3° across the bow to 60° abaft the beam, and similarly aft. Six 6-inch B.L.R., weighing about four tons each, will be mounted in broadside on the gun deck, with a train of 60° before and abaft the beam. This deck has been arranged and ports will be cut for two additional 6-in. guns on each broadside, which may be fitted if found desirable. One 6-inch will be mounted in a recessed gun-deck port on each bow, with a train of from 3° across the bow to 52° abaft the beam. Two 5-inch guns in recessed ports abaft the captain's cabin complete the main battery. There will be in addition, four 47-mm. and two 37-mm. Hotchkiss revolving cannon, mounted in fixed bullet-proof towers.

The Chicago is divided by nine complete transverse bulkheads extending to the gun deck, into ten main water-tight compartments. The four amidship compartments, extending over 136 feet in length, are occupied by the machinery and boilers. An inner bottom extends throughout this space, forming a double bottom 3 ft. 6 in. deep amidships, which is divided by the vertical keel and transverse water-tight frames into fourteen water-tight cells.

The machinery and boilers are covered by a protective steel deck 1½ inch in thickness. The top of this deck is one foot above the load water-line and is nearly flat, or has the ordinary round of the beams for about half the breadth amidships. At about 12 feet from the side it bends downwards, striking the side at 4 feet below the water-line. Vertical longitudinal bulkheads extend on each side of and throughout the length of the machinery and boiler compartments. The space between them and the sides of the ship will be filled with coal, giving a coal armour of 9 feet in thickness from the water-line to 8 feet above it, and aft an average thickness of 5 feet from the water-line to 14 feet below it. These coal bunkers, with the pockets in the boiler-rooms, form thirty-four water-tight compartments. The machinery compartments contain the vitals of the ship. It is not expected that the deck which covers them will resist a 6-inch shot at even so small inclinations as 6° to 8°; but the protection afforded by such a deck is of great value in preventing the direct access of shot and water to the main compartments, in resisting machine gun-fire, and from the fact that entering shell will probably explode among the coal without injury to the machinery.

The magazines, shell-rooms, and fixed ammunition-rooms are situated in the hold amidships, directly before and abaft the machinery space, only separated from the forward boiler-room by the

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cable tanks, and from the after engine-room by a handing and light-room. The flats beneath them are water-tight and form a virtual double bottom extending about 40 feet before and abaft that properly so called. The deck above them is covered by protecting plating ¾-in. thick, the remainder of this deck is of steel ¼-in. thick, making a complete water-tight flat. All hatches leading through it have water-tight covers, and the magazine hatches are surrounded by coffer-dams leading to the berth deck. Additional bulkheads of steel make other necessary divisions in the hold, and with the shaft alley bulkheads and those already mentioned divide the ship into eighty-five water-tight compartments.

A complete system of drainage is provided for by which the total pumping power of the steam and circulating pumps, with a capacity of 2500 tons per hour, can be concentrated on any main compartment.

URUGUAY.

Gunboat.—General Artiga, 274 tons, 520 I.H.P., 2 12-cm. B.L.R. (30 calibres, Krupp), 2 M., launched 1883, 12·60.

General Rivera (building), 300 tons, 1 15-cm. B.L.R., 1 6-cm. do. 12 knots.

Also a steamer of 400 tons displacement.

VENEZUELA.

Steamer.—Augusta, iron, launched in 1884.

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TURNING POWERS OF FOREIGN ARMOUR-CLADS.

N.B., abbreviation, 2 s., twin screws.

AUSTRIA.

Custoza. . . .	306	yards	diameter, in	4	minutes,	44	seconds,	at	11·5	knots.
Don Juan d'Austria .	355	„	„	4	„	29	„	„	12·0	„
Erzhezog Albrecht .	287	„	„	4	„	40	„	„	11·0	„
Ferdinand Max . .	563	„	„	9	„	53	„	„	11·5	„
Habsbourg . . .	1360	„	„	10	„	43	„	„	11·0	„
Kaiser	389	„	„	5	„	40	„	„	10·0	„
Kaiser Max . . .	437	„	„	4	„	27	„	„	?13·0	„
Lissa	456	„	„	6	„	25	„	„	11·0	„
Prinz Eugen . . .	—	„	„	4	„	30	„	„	?	„
Salamander . . .	787	„	„	7	„	15	„	„	9·5	„
Tegethoff . . .	400	„	„	4	„	10	„	„	13·0	„

BRAZIL.

Bahia, 2 s. . . .	?	yards	diameter, in	3	minutes,	40	seconds,	at	9·0	knots.
Javary, 2 s. . . .	328	„	„	6	„	0	„	„	?	„
Lima Barros, 2 s. .	219	„	„	4	„	0	„	„	11·5	„
Solimoes, 2 s. . .	328	„	„	6	„	0	„	„	?	„

CHILI.

Almirante Cochrane, 2 s.	300	yards	diameter, in	4	minutes,	20	seconds,	at	11·0	knots.
Huascar . . .	330	„	„	4	„	55	„	„	10·0	„

CHINA.

Ting-Yuen . . . 360 yards diameter, in 4 minutes, 30 seconds at 12·5 knots.

DENMARK.

Danmark . . .	600	yards	diameter, in	4	minutes,	40	seconds	at	7·5	knots.
Esbern Snare . .	200	„	„	3	„	15	„	„	10·5	„
Gorm	350	„	„	4	„	20	„	„	11·0	„
Helgoland, 2 s. . .	300	„	„	3	„	30	„	„	10·0	„
Lindormen, 2 s. . .	450	„	„	3	„	50	„	„	11·0	„
Odin	420	„	„	4	„	30	„	„	11·5	„
Peder Skram . .	500	„	„	5	„	10	„	„	10·0	„
Rolf Krake . . .	280	„	„	4	„	0	„	„	9·0	„

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FRANCE.

Atalante	. . .	350	yards	diameter, in	4	minutes,	40	seconds, at	8	knots.
Bayard.	. . .	305	„	„	4	„	15	„ „	12·5	„
Bélier, 2 s.	. . .	—	„	„	4	„	50	„ „	12·0	„
Belliqueuse	. . .	—	„	„	6	„	0	„ „	12·0	„
Bouledogue, 2 s.	.	310	„	„	4	„	22	„ „	12·0	„
Cerbère, 2 s.	. . .	408	„	„	4	„	42	„ „	10·5	„
Colbert	. . .	500	„	„	5	„	26	„ „	13·0	„
Dévastation	. . .	410	„	„	5	„	15	„ „	12·0	„
Friedland	. . .	540	„	„	6	„	0	„ „	11·5	„
La Galissonnière, 2 s.	.	522	„	„	5	„	45	„ „	12·0	„
Marengo	. . .	640	„	„	5	„	12	„ „	12·5	„
Montcalm	. . .	344	„	„	6	„	24	„ „	9·0	„
Océan	. . .	540	„	„	5	„	20	„ „	12·0	„
Onondaga, 2 s.	. .	260	„	„	6	„	30	„ „	?	„
Provence	. . .	518	„	„	5	„	20	„ „	11·5	„
Richelieu, 2 s.	. .	512	„	„	6	„	24	„ „	12·0	„
Reine Blanche	. .	—	„	„	6	„	20	„ „	9·0	„
Suffren	. . .	588	„	„	5	„	58	„ „	13·5	„
Taurean, 2 s.	. .	145	„	„	4	„	0	„ „	?	„
Tempête	. . .	355	„	„	3	„	30	„ „	12·5	„
Thétis	. . .	—	„	„	6	„	35	„ „	9·0	„
Tigre, 2 s.	. . .	—	„	„	4	„	30	„ „	11·0	„
Tonnere	. . .	335	„	„	3	„	48	„ „	12·5	„
Trident	. . .	494	„	„	6	„	22	„ „	13·0	„
Triomphante	. .	550	„	„	5	„	50	„ „	10·5	„
Victorieuse	. . .	550	„	„	5	„	30	„ „	10·5	„

GERMANY.

Arminius	. . .	400	yards	diameter, in	4	minutes,	10	seconds, at	10·0	knots.
Deutschland	. .	590	„	„	3	„	47	„ „	14.0	„
Friedrich Carl	. .	590	„	„	6	„	0	„ „	12·0	„
Friedrich der Grosse	.	557	„	„	4	„	45	„ „	13·0	„
Hansa	. . .	420	„	„	4	„	0	„ „	10·5	„
Kaiser	. . .	540	„	„	3	„	6	„ „	14·0	„
König Wilhelm	. .	720	„	„	7	„	50	„ „	13·5	„
Kronprinz	. . .	600	„	„	5	„	30	„ „	13·5	„
Preussen	. . .	530	„	„	5	„	10	„ „	13·0	„
Sachsen, 2 s.	. . .	360	„	„	3	„	40	„ „	13·0	„
Wespe, 2 s.	. . .	130	„	„	2	„	30	„ „	9·0	„

GREECE.

King George, 2 s.	. .	—	yards	diameter, in	3	minutes.	50	seconds, at	?	knots.
Olga	. . . .	430	„	„	5	„	0	„ „	9·5	„

ITALY.

Affondatore	. . .	765	yards	diameter, in	5	minutes,	0	seconds, at	13·0	knots
Ancona	. . .	528	„	„	6	„	0	„ „	13.4	„
Castelfidardo	. .	528	„	„	6	„	0	„ „	13·4	„
Duilio, 2 s.	. . .	220	„	„	5	„	10	„ „	?	„
Maria Pia	. . .	528	„	„	6	„	0	„ „	13·4	„
Palestro	. . .	380	„	„	5	„	43	„ „	12·0	„
Principe Amedeo	. .	410	„	„	5	„	36	„ „	11·5	„
San Martino	. .	528	„	„	6	„	0	„ „	13·4	„

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JAPAN.

Fu Soo, 2 s. . . .	—	yards	diameter,	in	3	minutes,	30	seconds,	at	? knots

NETHERLANDS.

Buffel, 2 s. . . .	—	yards	diameter,	in	4	minutes,	0	seconds,	at	? knots.
Hyena, 2 s. . . .	360	„	„		6	„	2	„	„	7·5 „
Prins Hendrick der Nederlanden . .	—	„	„		4	„	35	„	„	? „
Stier	—	„	„		4	„	30	„	„	? „

NORWAY.

Mjölner* . . .	150	yards	diameter,	in	4	minutes,	0	seconds,	at	7·5 knots.
Skorpionen . . .	150	„	„		3	„	10	„	„	6·5 „
Thor	188	„	„		4	„	30	„	„	8·2 „

PORTUGAL.

Vasco de Gama, 2 s. .	285	yards	diameter,	in	4	minutes,	0	seconds,	at	? 13·5 knots.

RUSSIA.

Admiral Chichagoff .	486	yards	diameter,	in	6	minutes,	30	seconds,	at	9·0 knots.
Admiral Greig . .	450	„	„		6	„	30	„	„	9·5 „
Admiral Lazareff . .	450	„	„		6	„	50	„	„	9·5 „
Admiral Spiridoff . .	460	„	„		6	„	45	„	„	9·0 „
Bronenosetz . . .	200	„	„		4	„	33	„	„	7·7 „
Czarodijka, 2 s. . .	390	„	„		5	„	20	„	„	7·5 „
Dimitri Donskoi,† 2 s. .	—	„	„		8	„	10	„	„	11·0 „
Duke of Edinburgh .	460	„	„		5	„	12	„	„	13·0 „
Edinorog . . .	280	„	„		4	„	50	„	„	6·0 „
General Admiral . .	490	„	„		4	„	50	„	„	13·0 „
Kniaz Pojarski . .	550	„	„		7	„	50	„	„	10·0 „
Koldun . . .	198	„	„		4	„	30	„	„	8·2 „
Kreml	512	„	„		6	„	20	„	„	7·5 „
Latnik . . .	214	„	„		4	„	40	„	„	6·5 „
Lava	235	„	„		5	„	10	„	„	7·0 „
Minin	544	„	„		5	„	30	„	„	10·0 „
Netrony-Mena . .	480	„	„		5	„	40	„	„	7·5 „
Pervenetz . . .	510	„	„		6	„	30	„	„	8·0 „
Perun	200	„	„		4	„	46	„	„	5·0 „
Smertz . . .	—	„	„		4	„	58	„	„	? „
Streletz . . .	250	„	„		5	„	0	„	„	5·5 „
Tifon	180	„	„		5	„	30	„	„	5·5 „
Uragan . . .	175	„	„		4	„	15	„	„	7·0 „
Veshtchun . . .	178	„	„		5	„	0	„	„	6·5 „

* Nijölner completes full circle in 5 min. 30 sec. Thrudvany completes full circle in 5 min. 30 sec.

† Hard-a-port helm, both engines going ahead. With the helm hard-a-port, port engine going ahead, and starboard astern, the circle was completed in 7 min. 52 sec. Helm amidships, port engine ahead, starboard astern, the time was 7 min. 7 sec. Helm hard-a-port, port engine ahead, starboard stopped, the time was 7 min. 20 sec., speed 8 to 8·5 knots. 1. Hard-a-port, port engine ahead, starboard astern, full circle, 7 min. 52 sec. 2. Helm amidships, port engine ahead, starboard astern, 7 min. 7 sec. 3. Hard-a-port, both engines ahead, speed 11 knots, 8 min. 10 sec. 4. Hard-a-port, port engine ahead, starboard stopped (8 to 8¼ knots), 7 min. 20 sec. 5. 20° to starboard, both engines ahead, 13 knots, 8 min. 45 sec. 6. 25° to starboard, both engines ahead, 11 to 12¼ knots, 7 min. 50 sec.

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SPAIN.

Mendez Munez	.	.	600	yards	diameter, in	5	minutes,	10	seconds, at	6·0 knots.
Numancia	.	.	610	„	„	7	„	55	„	„ 12·0 „
Vitoria	.	.	544	„	„	7	„	30	„	„ 12·5 „
Zaragoza	.	.	520	„	„	6	„	0	„	„ 10·0 „

SWEDEN.

Garmer	.	.	145	yards	diameter, in	4	minutes,	55	seconds, at	4·5 knots.
John Ericsson	.	.	166	„	„	6	„	40	„	„ 7·0 „
Loke	.	.	180	„	„	5	„	40	„	„ 8·0 „

TURKEY.

Azizieh	.	.	1000	yards	diameter, in	8	minutes,	20	seconds, at	13·0 knots.
Assar-i-Schefket, 2 s.	.		384	„	„	4	„	55	„	„ 10·5 „
Assar-i-Tefoik	.		475	„	„	4	„	30	„	„ 12·5 „
Avni-Illah, 2 s.	.		—	„	„	6	„	0	„	„ ? „
Feth-i-Bulend	.		520	„	„	4	„	40	„	„ 13·4 „
Hufzi-ul-Rahman	.		560	„	„	5	„	0	„	„ 11·0 „
Idjilalieh	.	.	380	„	„	5	„	0	„	„ 10·0 „
Mahmudieh	.	.	950	„	„	7	„	30	„	„ 11·5 „
Mesendieh	.	.	975	„	„	6	„	20	„	„ 13·0 „
Muin-i-Zaffer, 2 s.	.		—	„	„	6	„	0	„	„ ? „
Mukadem-i-Haïr	.		500	„	„	5	„	0	„	„ 12·5 „
Orkaineh	.	.	1000	„	„	8	„	0	„	„ 12·0 „
Osmanieh	.	.	860	„	„	7	„	50	„	„ 11·5 „

UNITED STATES.

Mahopac, 2 s.	.		300	yards	diameter, in	6	minutes,	36	seconds, at	4·0 knots.
Manhattan, 2 s.	.		—	„	„	6	„	49	„	„ 4·0 „
Passaic, 2 s.	.		350	„	„	5	„	0	„	„ 4·5 „

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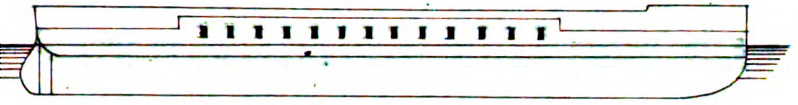
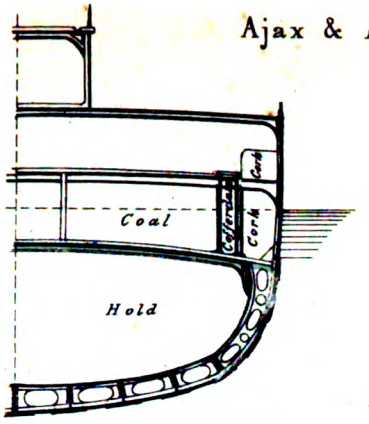
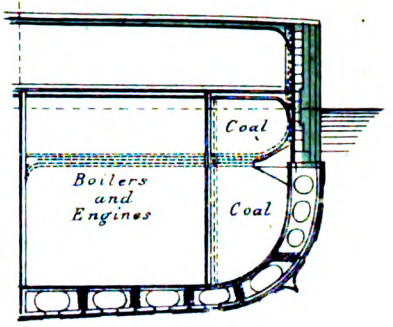
Achilles.



Ajax & Agamemnon.

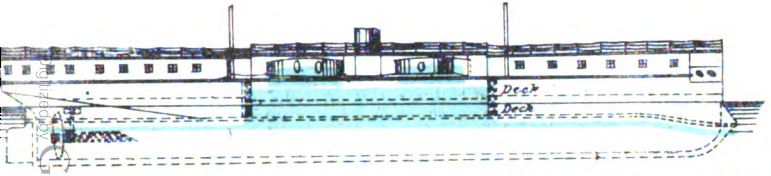


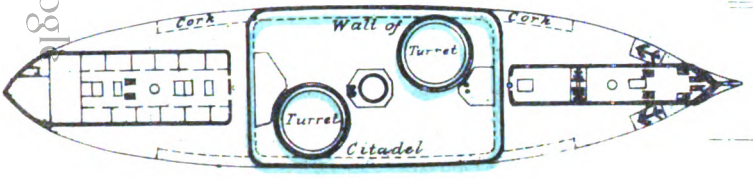
Section outside Citadel



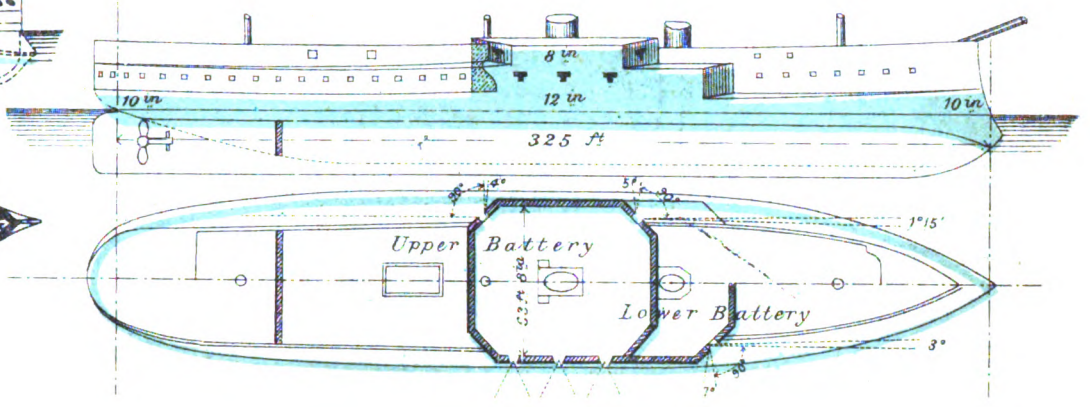
Midship Section

Ajax & Agamemnon.





Alexandra.



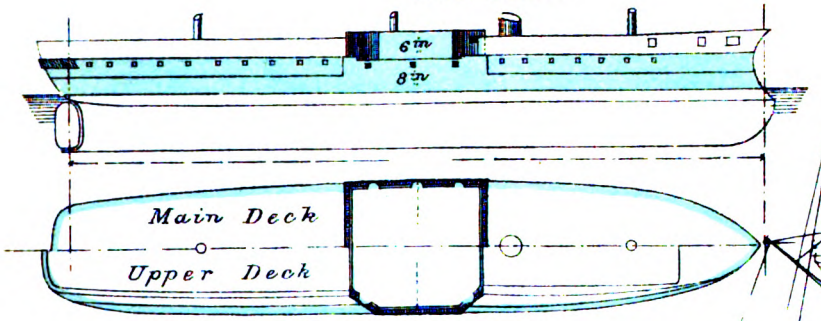
HANHART LITH.

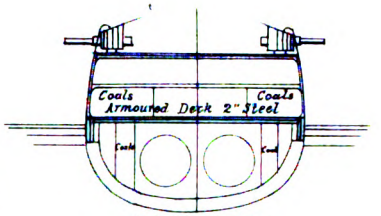
BRITISH SHIPS.

"Audacious"
Invincible.
Iron Duke.

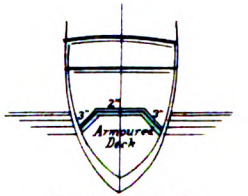
"Aurora" . "Australia"
Galatea, Immortalité, Narcissus, Orlando, Undaunted.

Pl. 2

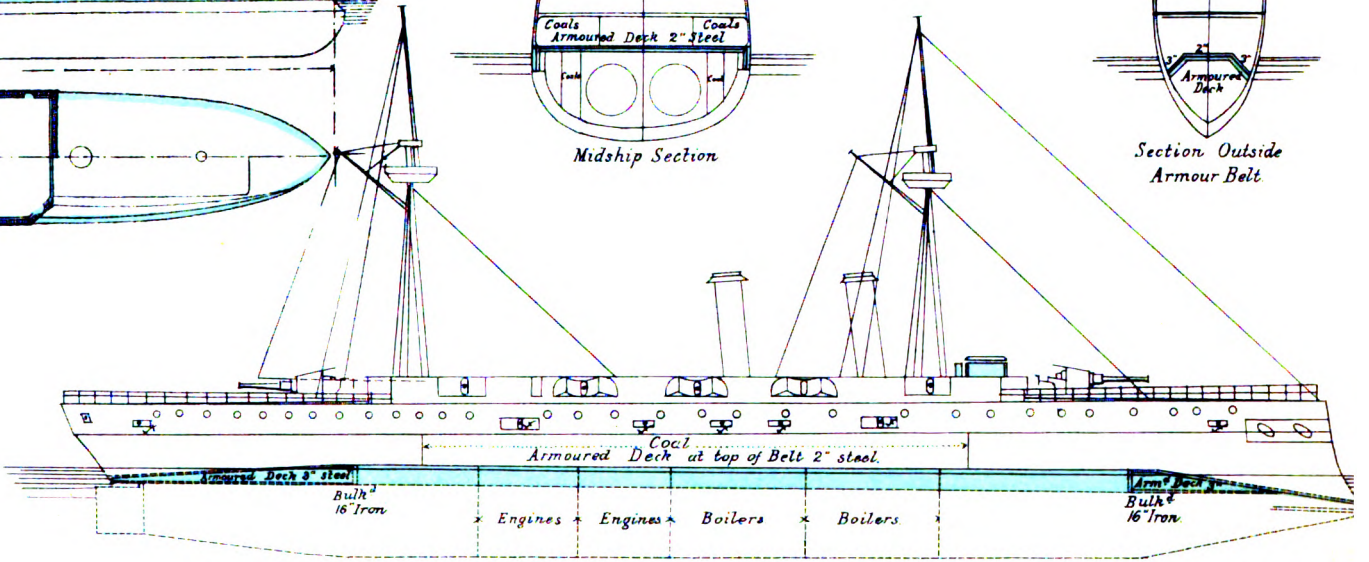




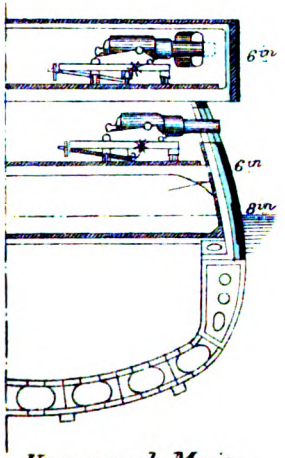
Midship Section



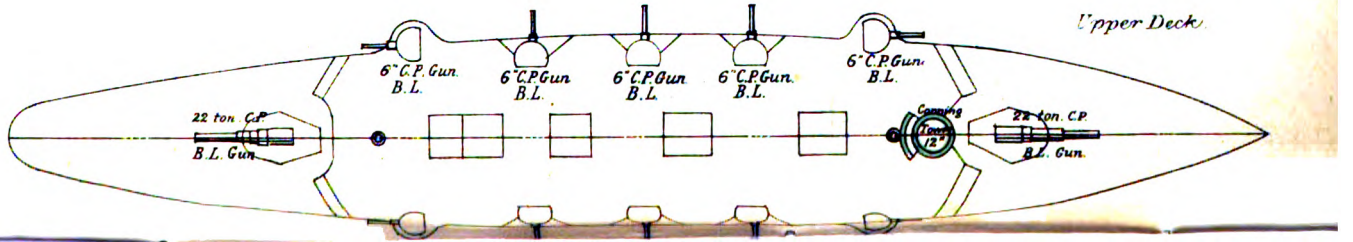
Section Outside Armour Belt



✓ Quick firing guns.



Upper and Main Batteries,
"Audacious" Class



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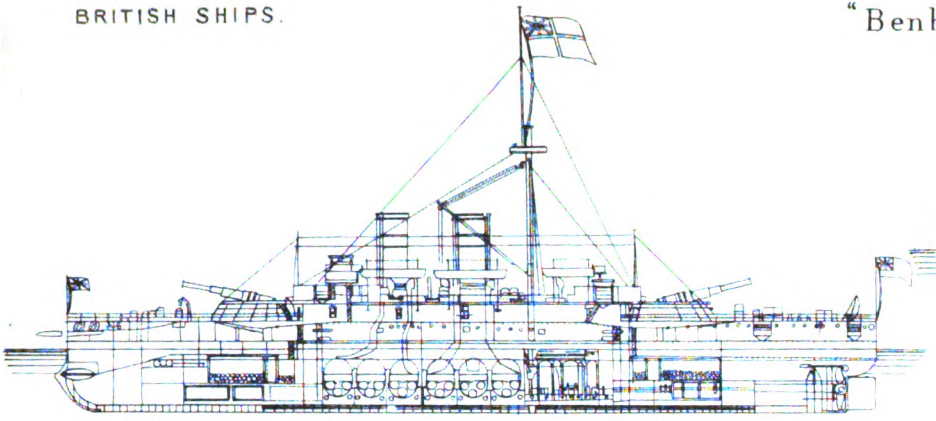
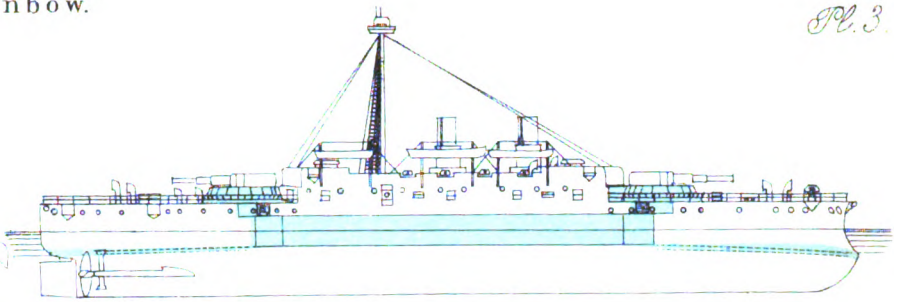
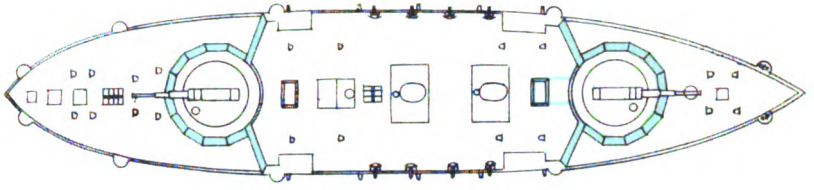
"Benbow."

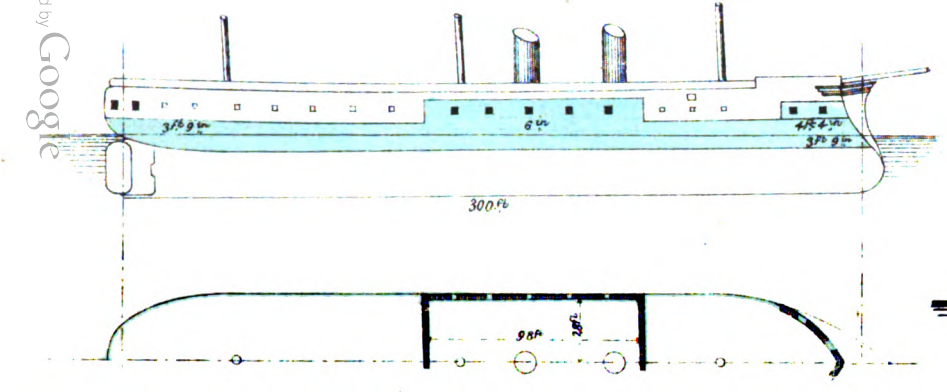




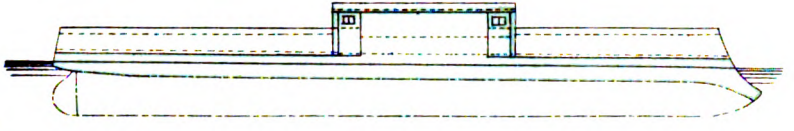
Spar Deck.



Bellerophon



"Belleisle" & "Orion".



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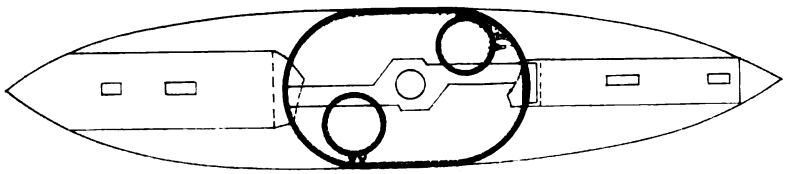
HANHART LITH.

Colossus & Edinburgh.



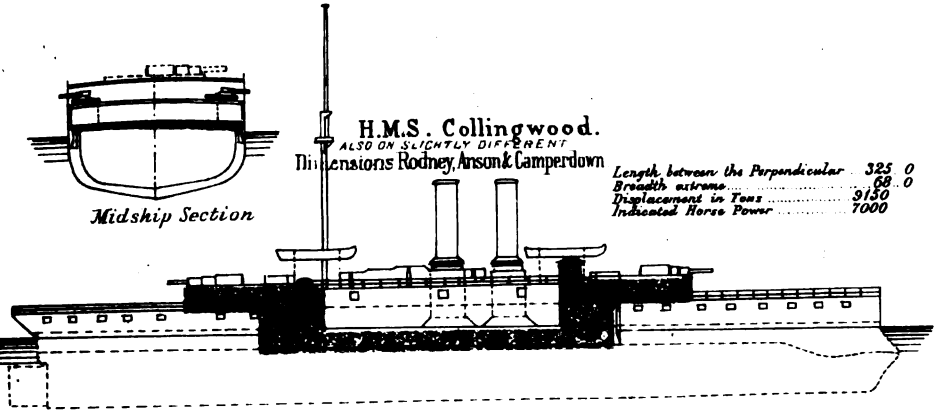
Midship Section

H.M.S. Collingwood.

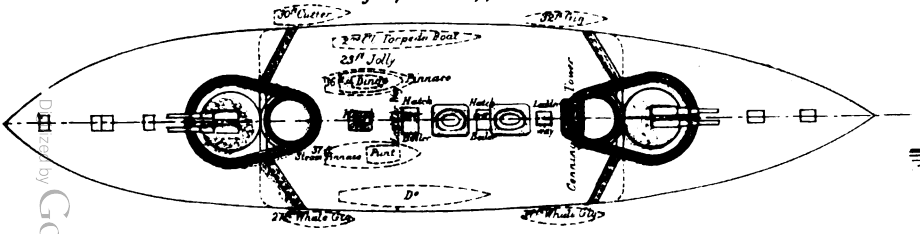
ALSO ON SLIGHTLY DIFFERENT

Dimensions Rodney, Anson & Camperdown

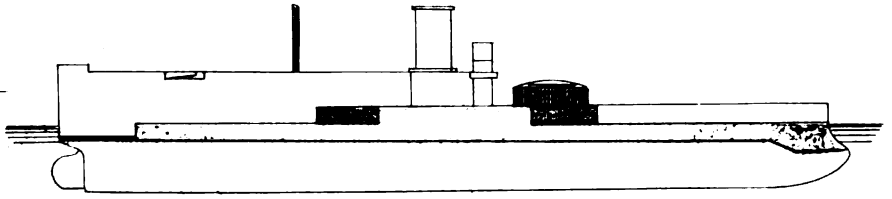
Length between the Perpendicular	325 0
Breadth extreme	68 0
Displacement in Tons	9150
Indicated Horse Power	7000



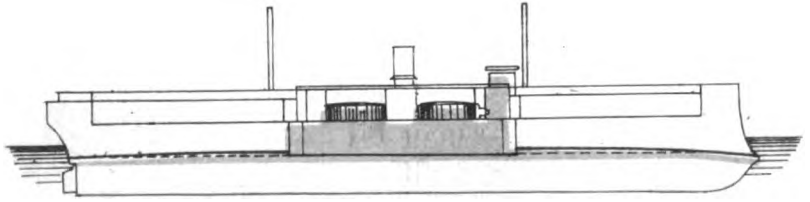
Plan of Spar & Upper Decks.

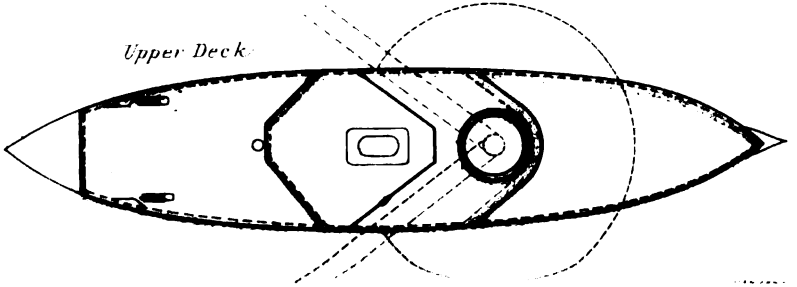


Conqueror. & Hero.



Colossus & Edinburgh.





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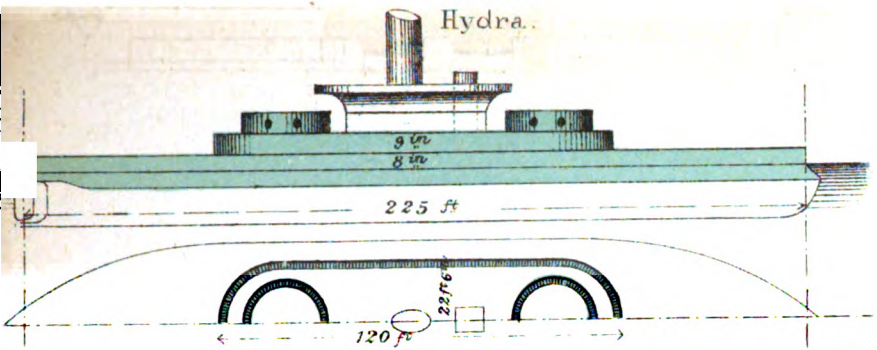
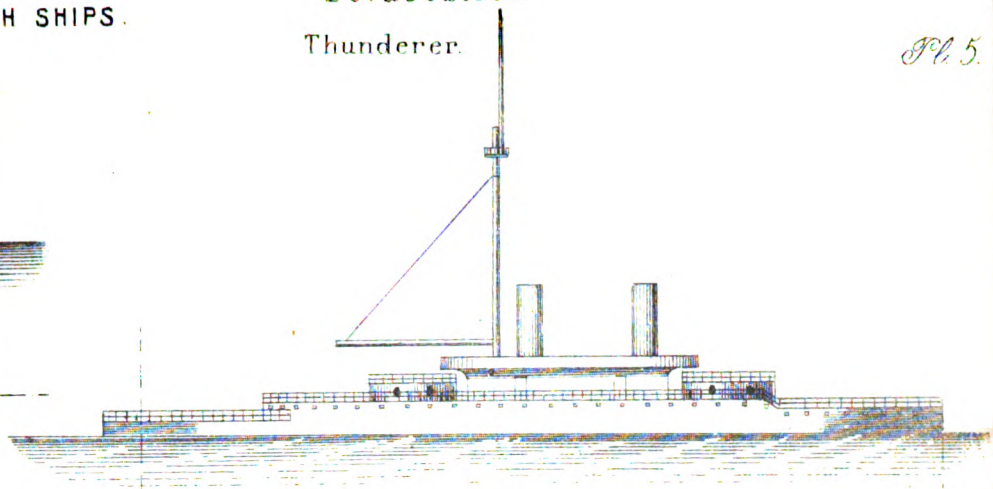
BRITISH SHIPS.

Pl. 5.

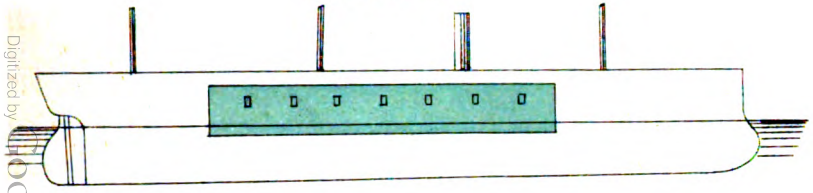
"Cyclops" Gorgon.
Hecate.
Hydra.

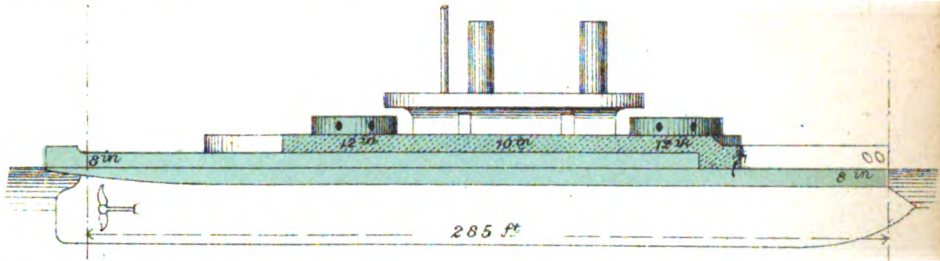


"Devastation"
Thunderer.

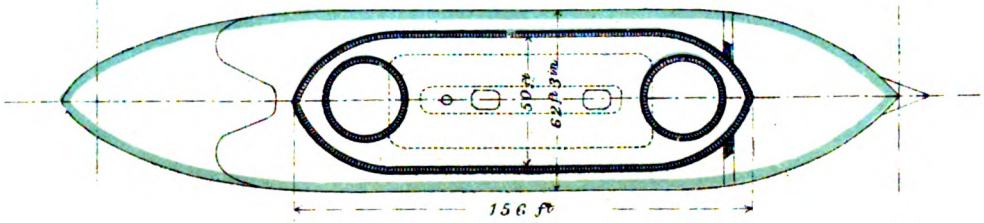


"Defence"
Resistance.





Upper Deck Devastation & Thunderer.



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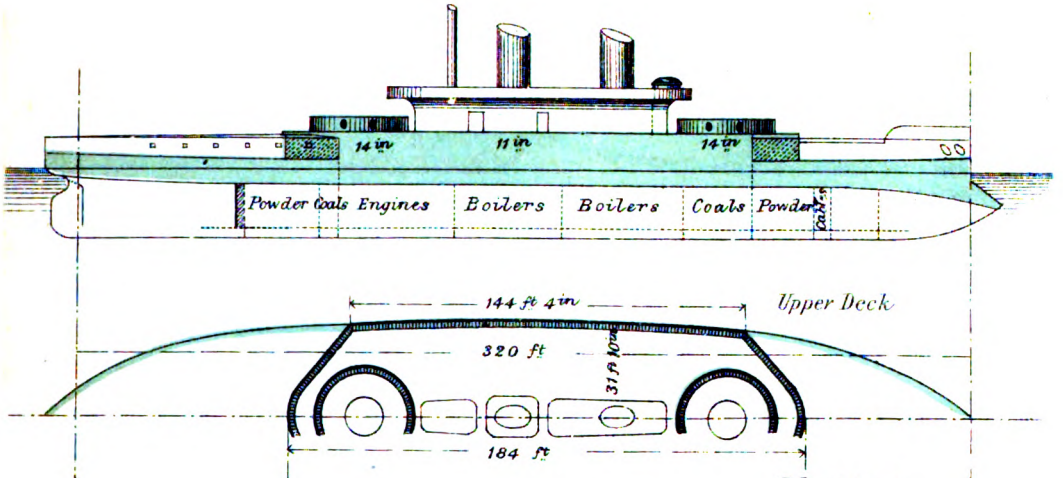
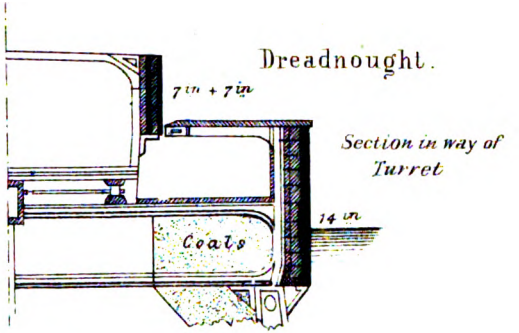
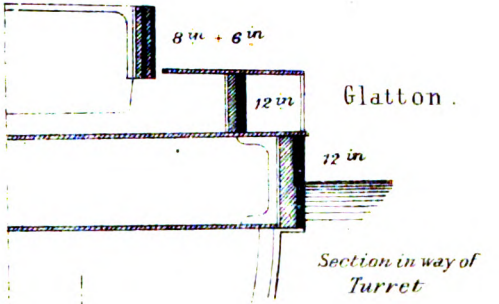
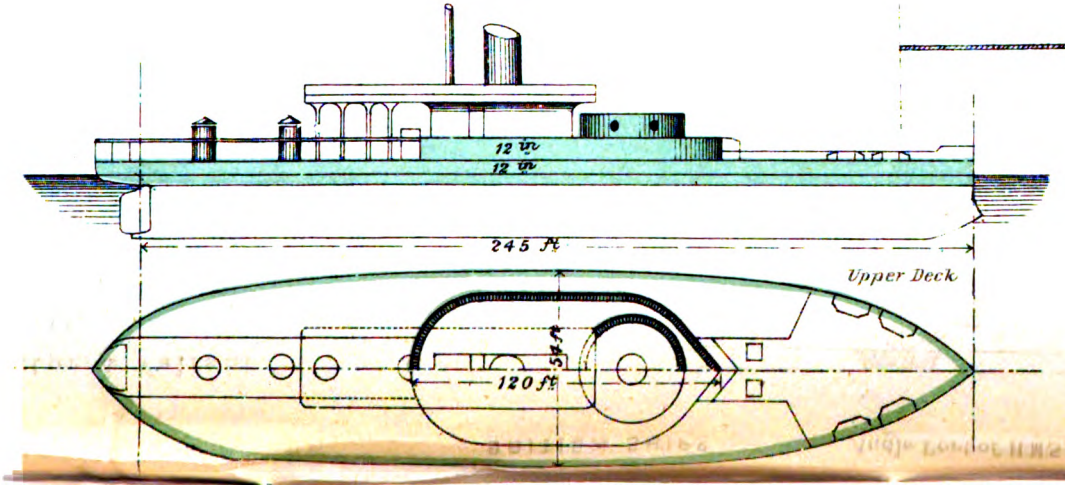


Dreadnought.





Glatton.



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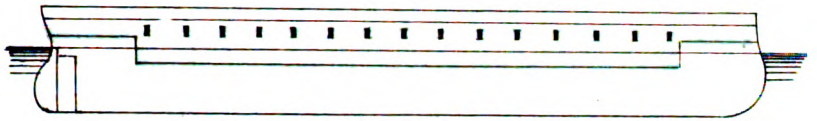
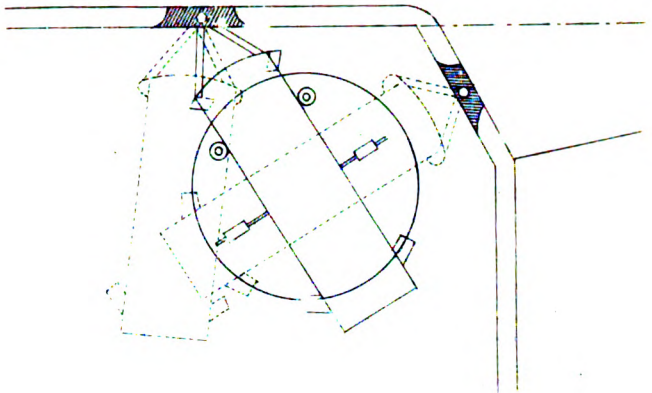
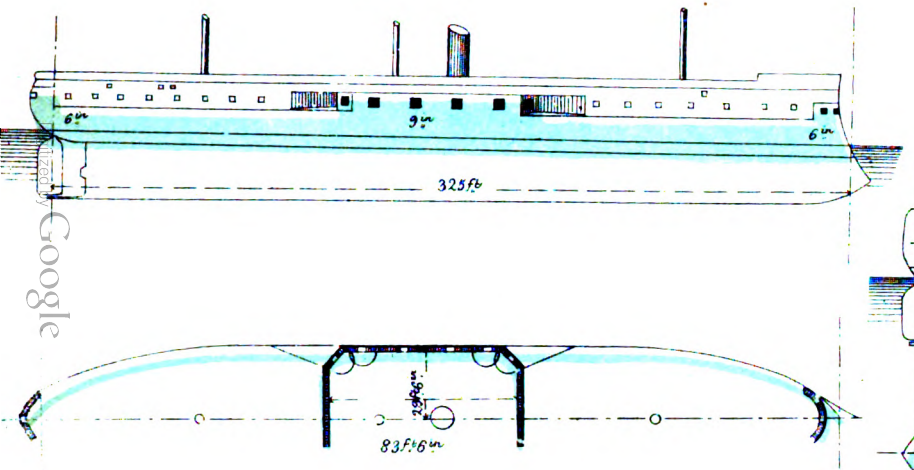
Angle Port of H.M.S. Hercules.

Hector & Valiant.

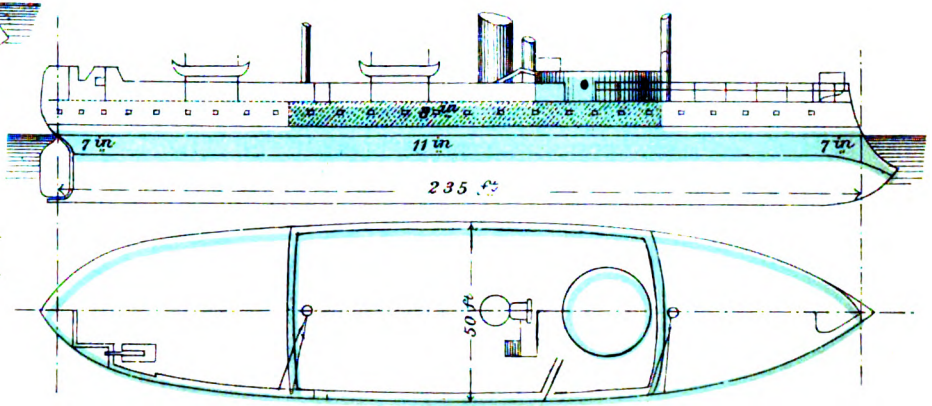




Hercules.



Hotspur.



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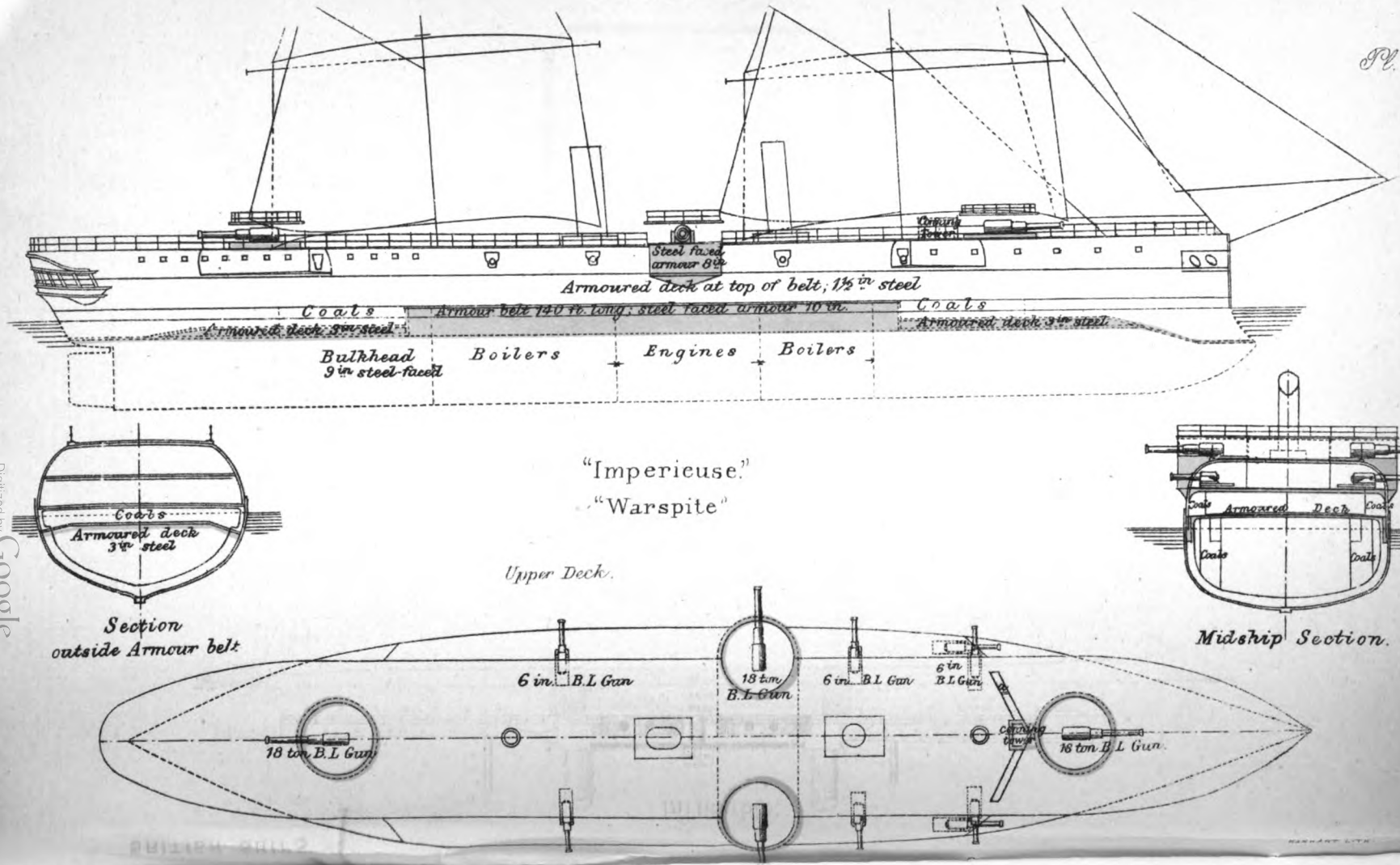
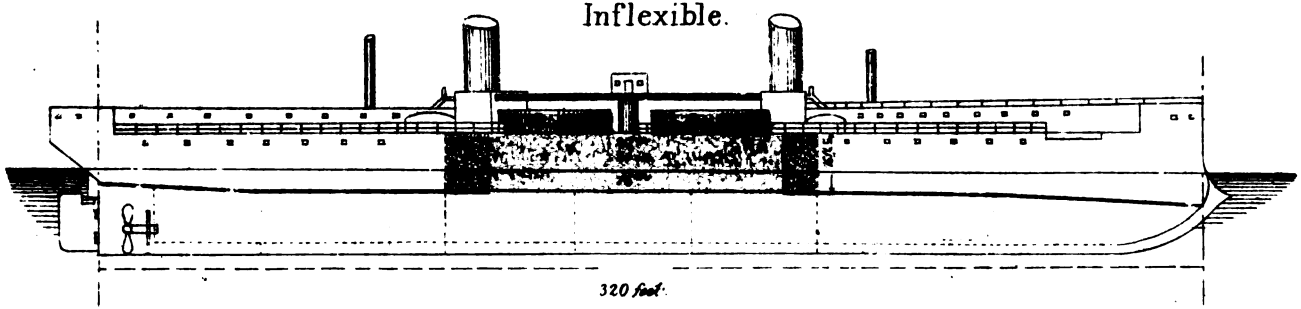
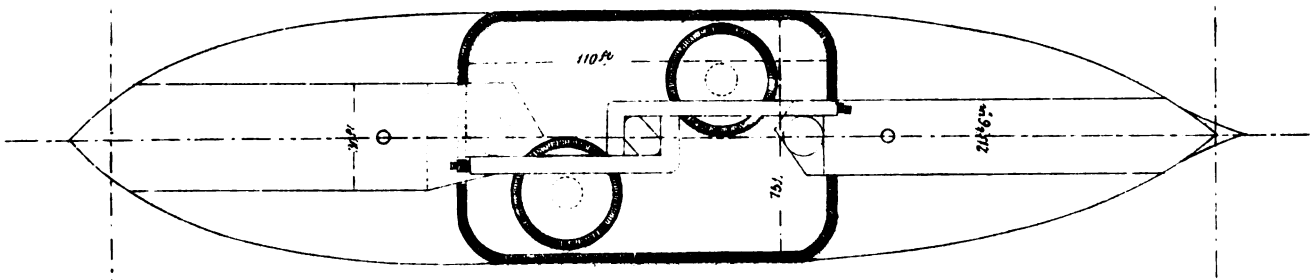

Steel faced armour 8 in
Armoured deck at top of belt; 1½ in steel
Coals
Armour belt 140 ft. long; steel faced armour 10 in.
Coals
Armoured deck 3 in steel
Armoured deck 3 in steel
Bulkhead 9 in steel-faced
Boilers
Engines
Boilers
Coals
Armoured deck 3 in steel
Section outside Armour belt
"Imperieuse."
"Warspite"
Armoured Deck
Coals
Midship Section.
Upper Deck.
6 in B.L Gun
18 ton B.L Gun
6 in B.L Gun
6 in B.L Gun
18 ton B.L Gun
18 ton B.L Gun

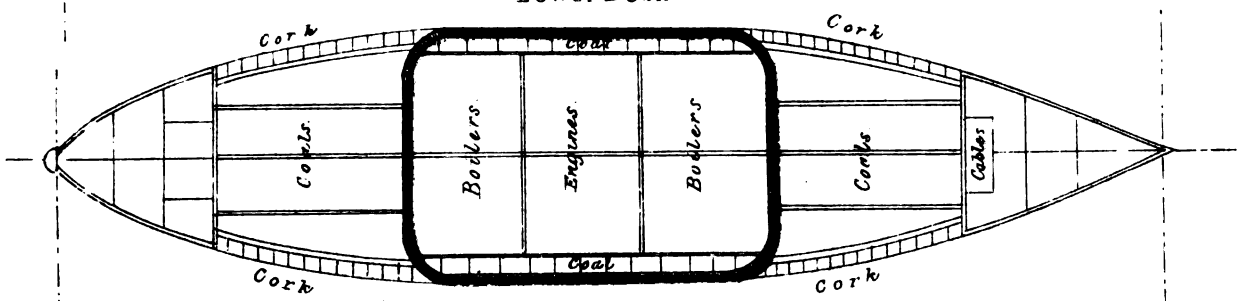
Inflexible.



Upper Deck



Lower Deck



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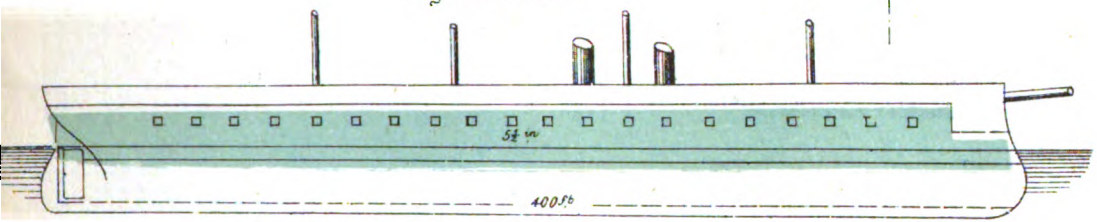
HANHART LITH.

BRITISH SHIPS.

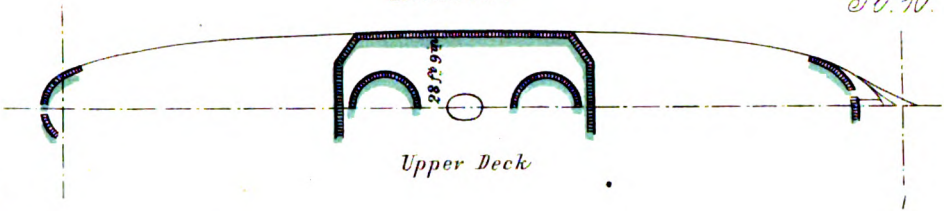
Pl. 10.

"Minotaur"

Agincourt.

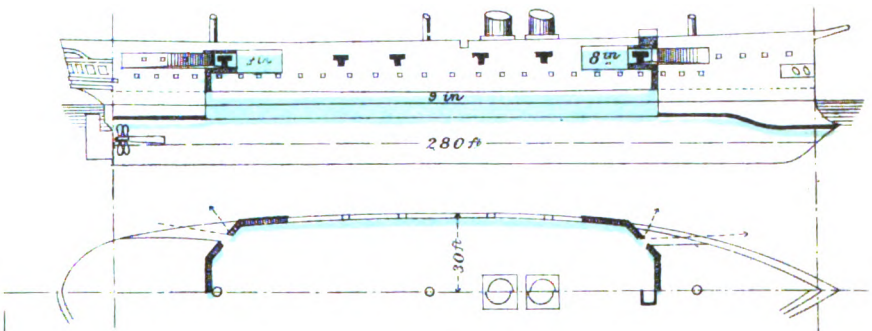


Monarch.

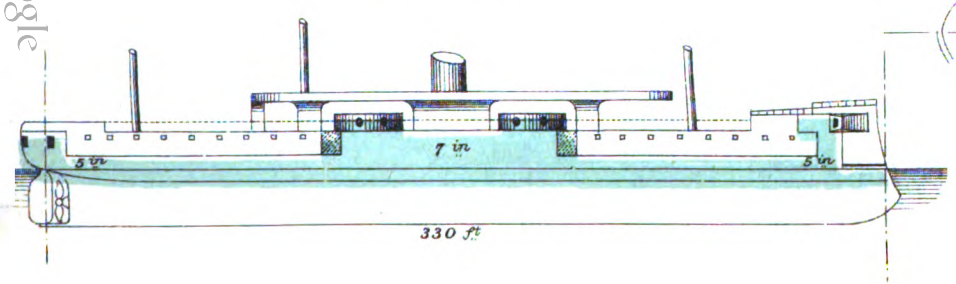


Nelson.

Northampton.



Monarch.



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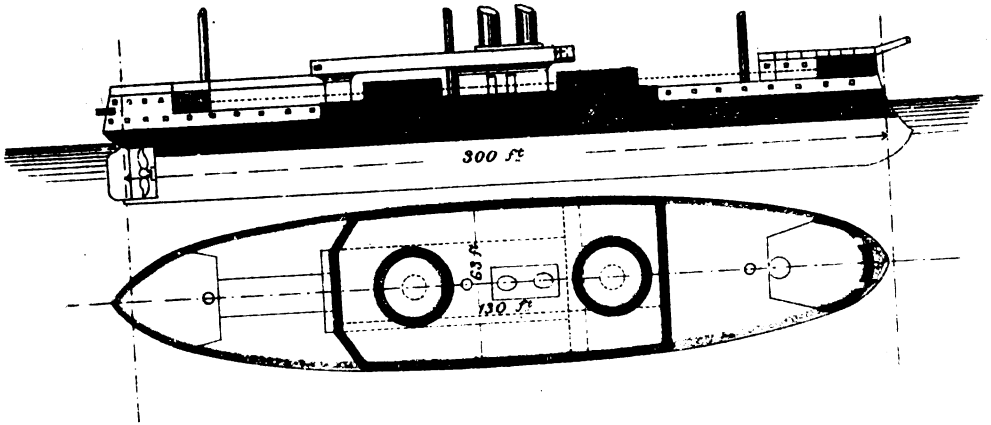
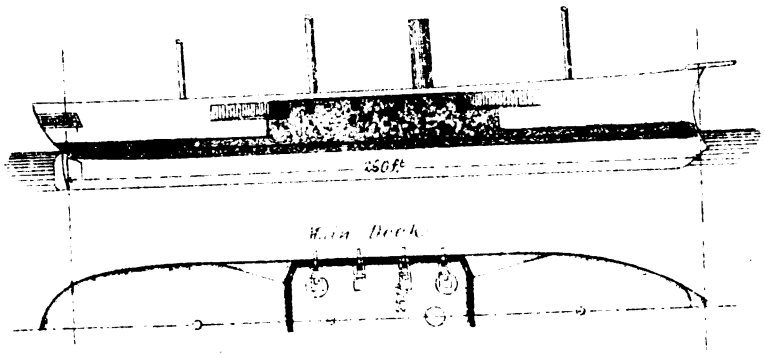
Neptune



Penelope



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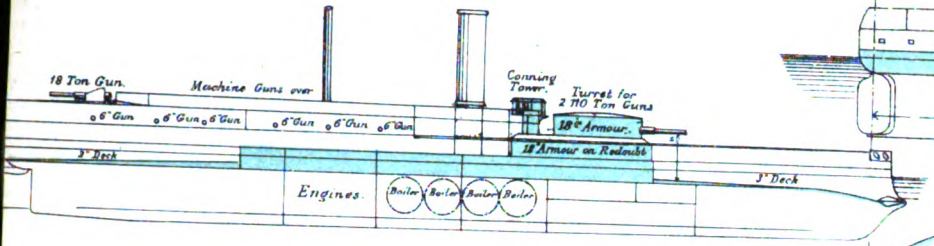
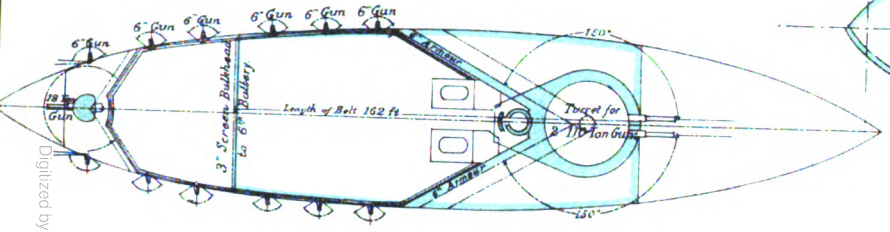
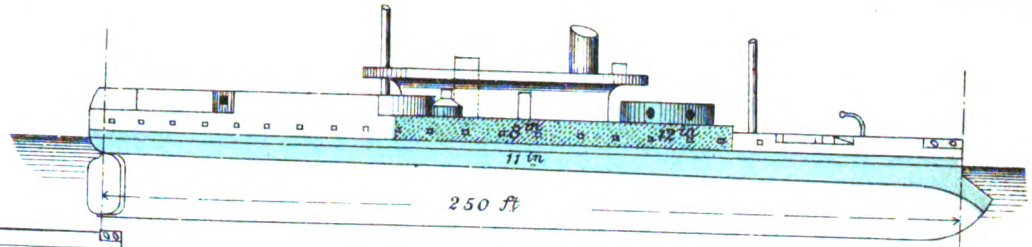
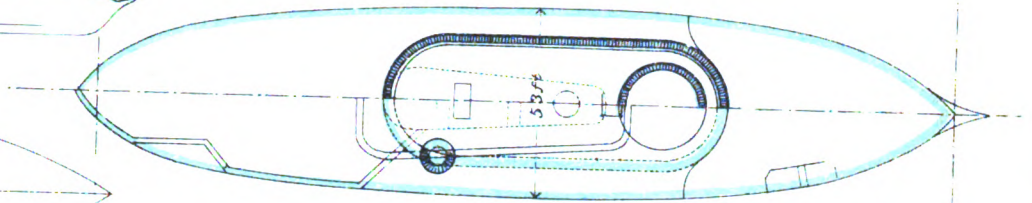
Renown. & Sans Pareil.



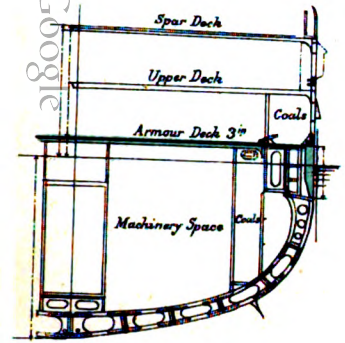


Rupert.

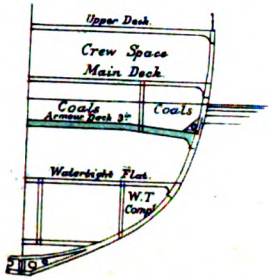




Breastwork Deck

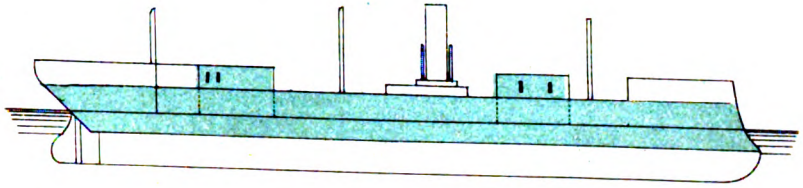


Midship Section



Section before Turret

Scorpion & Wyvern.



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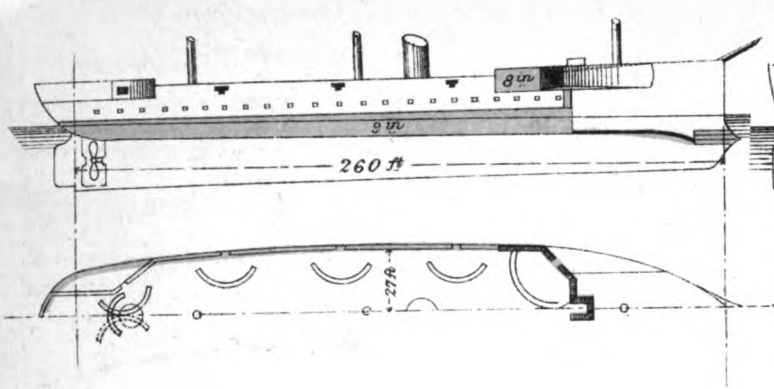
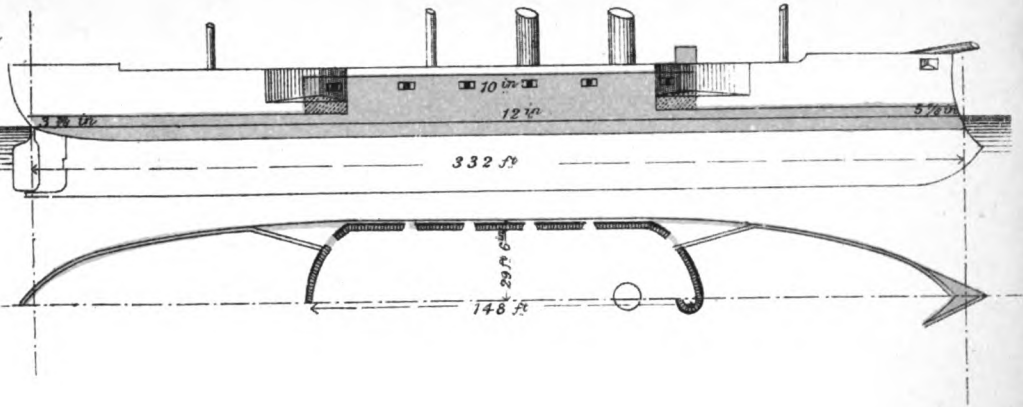
BRITISH SHIPS.

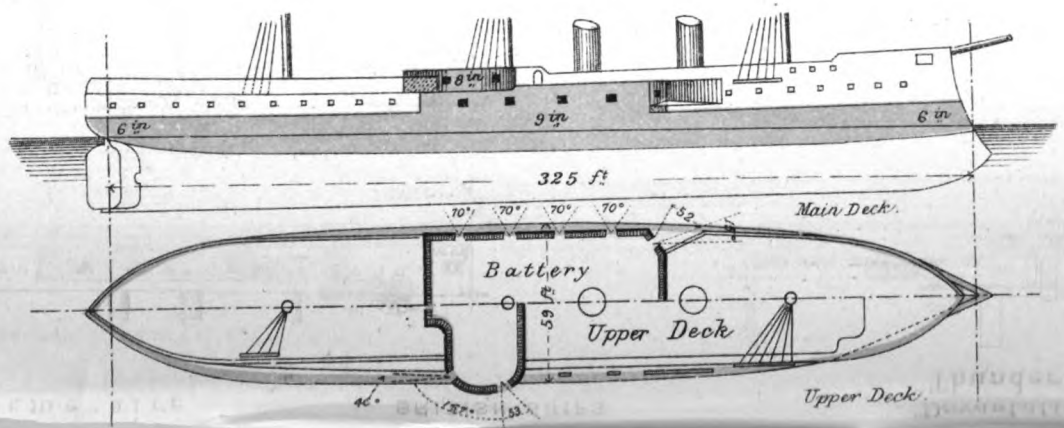
Shannon.



Superb.



Sultan.



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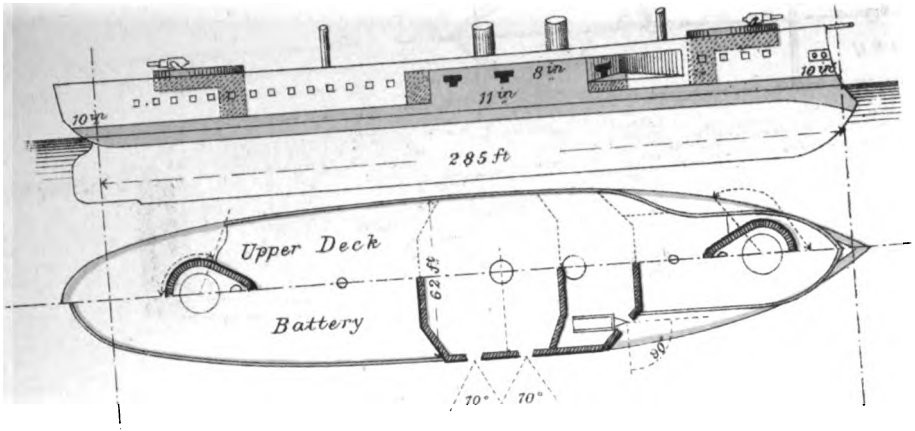
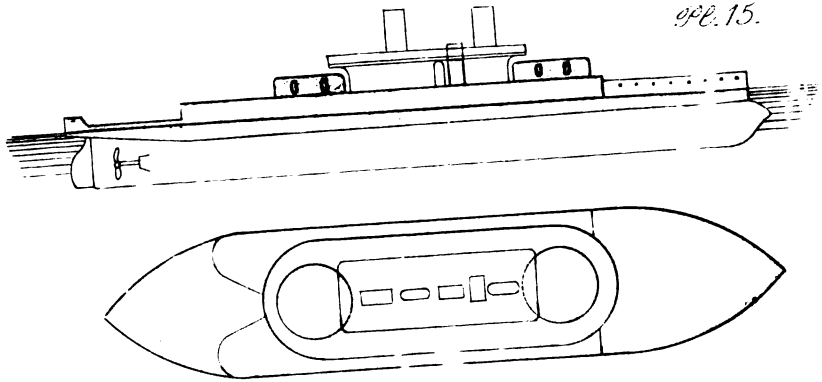
BRITISH SHIPS.

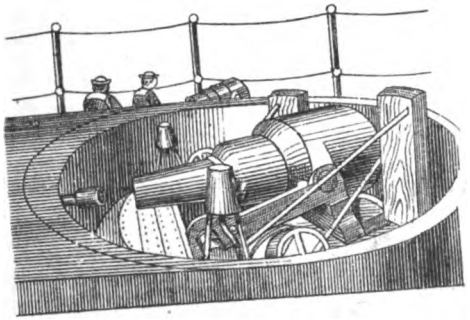
Temeraire



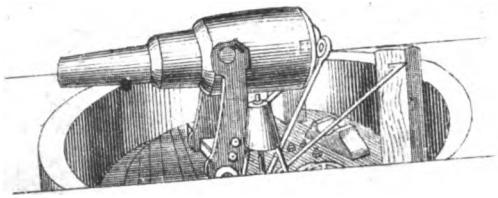
"Devastation" "Thunderer"

opp. 15.

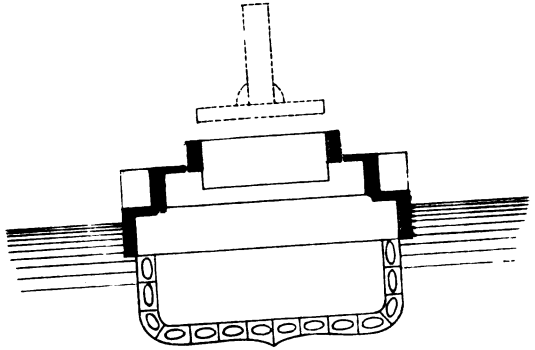




Téméraire's Gun, loading position.



Téméraire's Gun, firing position.



Midship Section

HANHART LITH

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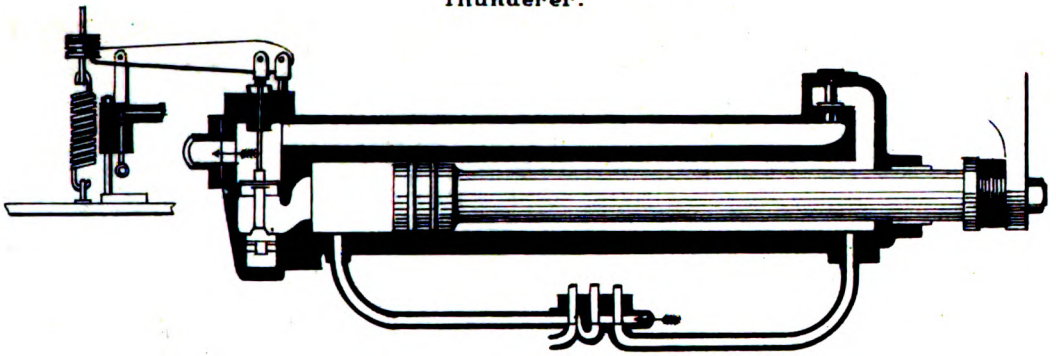
BRITISH SHIPS.

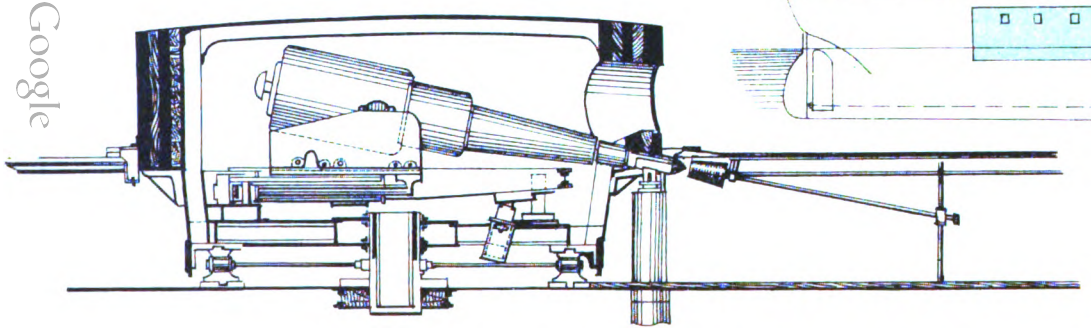
Thunderer.

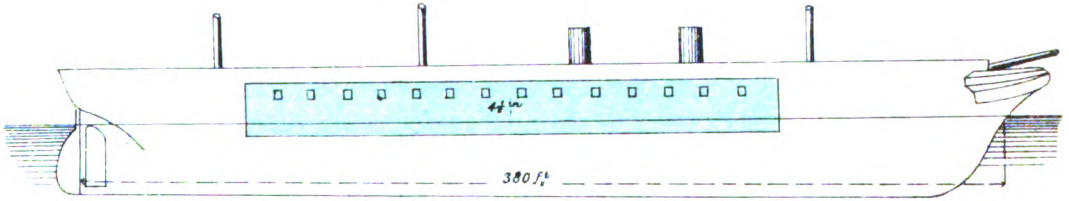


Warrior

Black Prince.

Thunderer.





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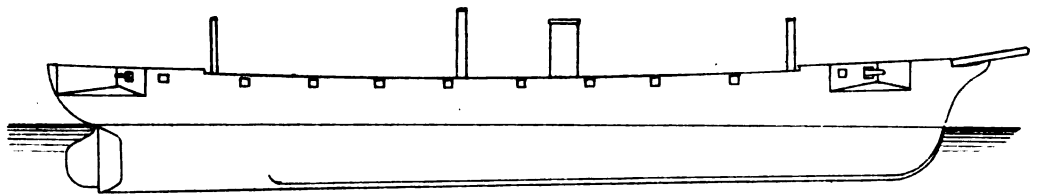
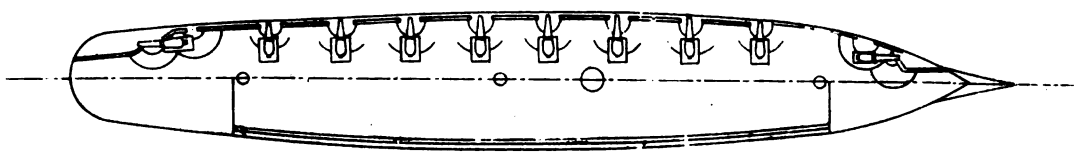
BRITISH SHIPS.

"Active" & "Volage".





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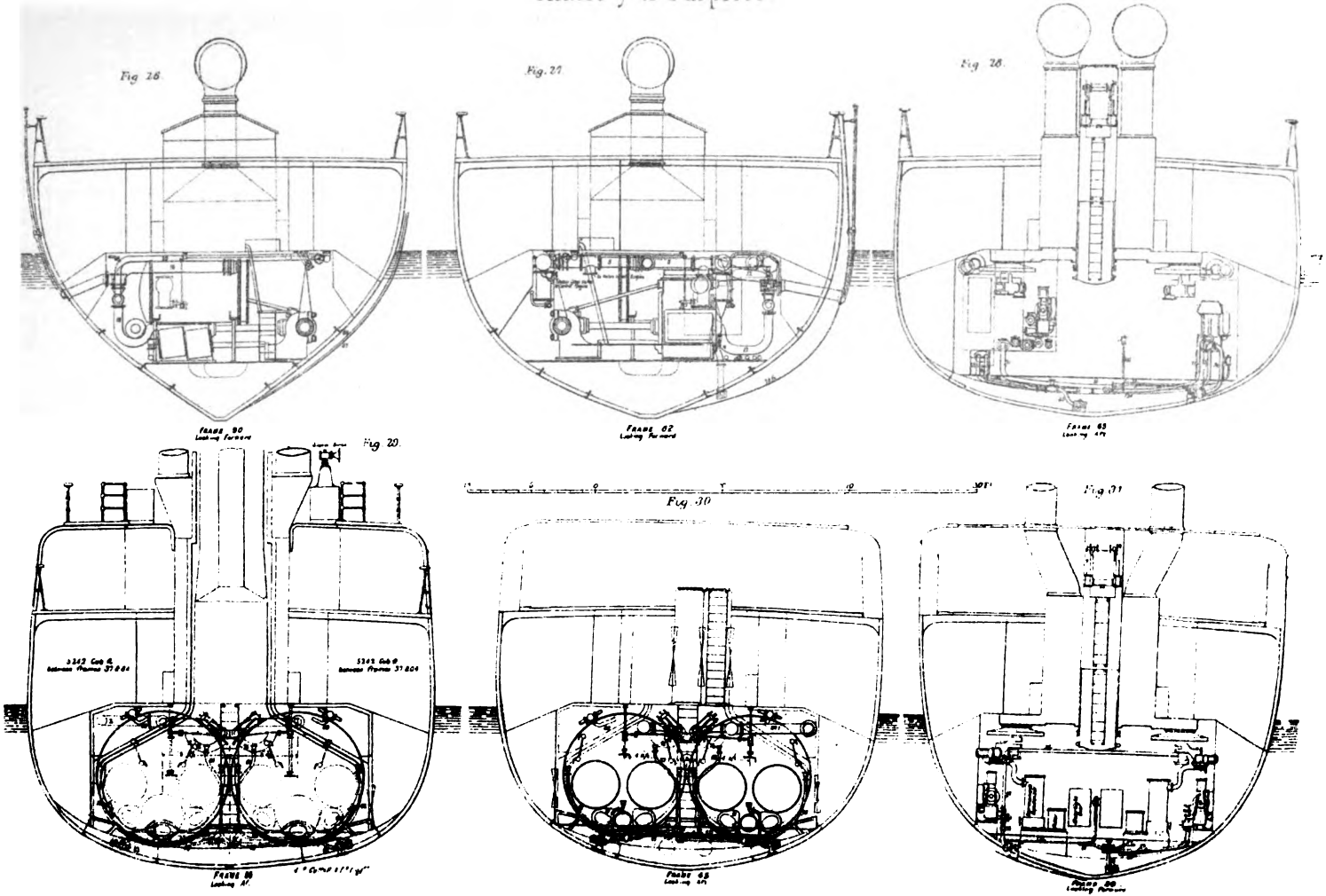
HANHART LITH.

"Alacrity" & "Surprise"



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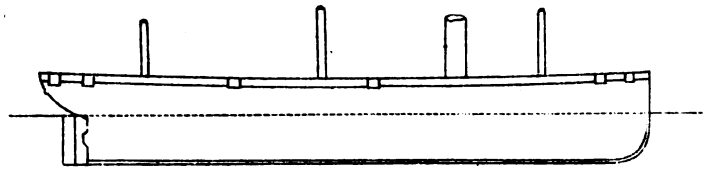
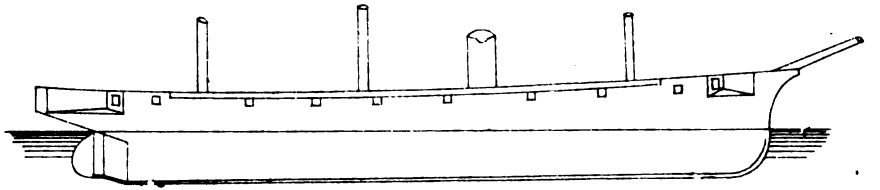
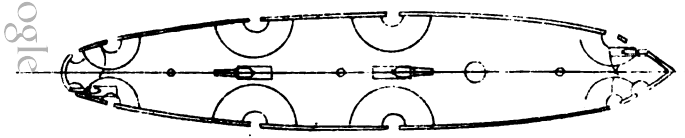
"Albatros"



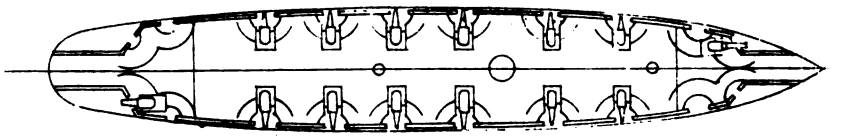
"Amethyst"
"Modeste"
"Diamond"



"Albatros" class



"Amethyst".
"Modeste"
"Diamond"



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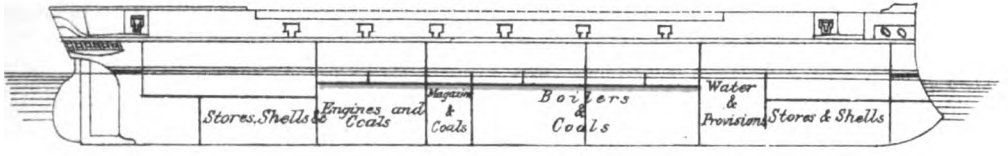
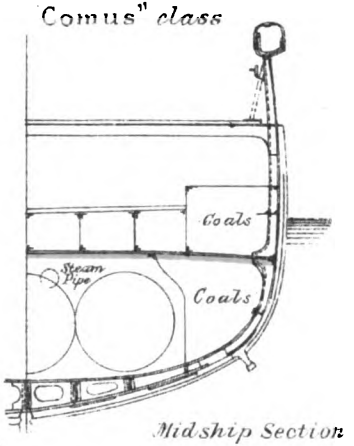
Canada
Constance
Cordelia.
Carysfort
Champion
Cleopatra
Comus
Conquest
Curacoa

Ships of Comus *class*.

"Comus" *class*

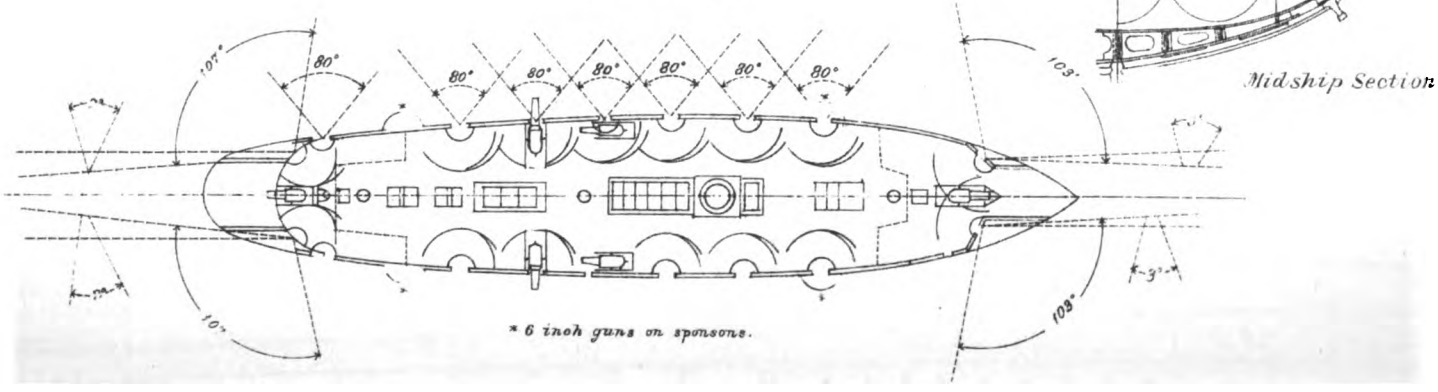


"Comus" *class*



Midship Section

"Comus" *class*



* 6 inch guns on sponsons.

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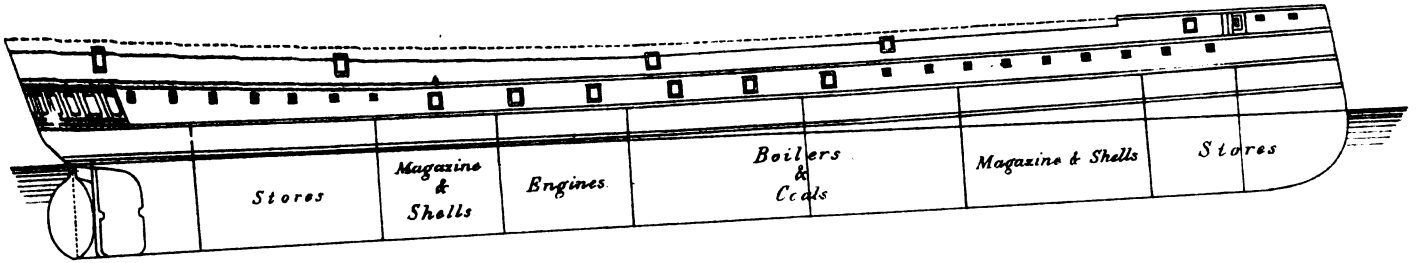
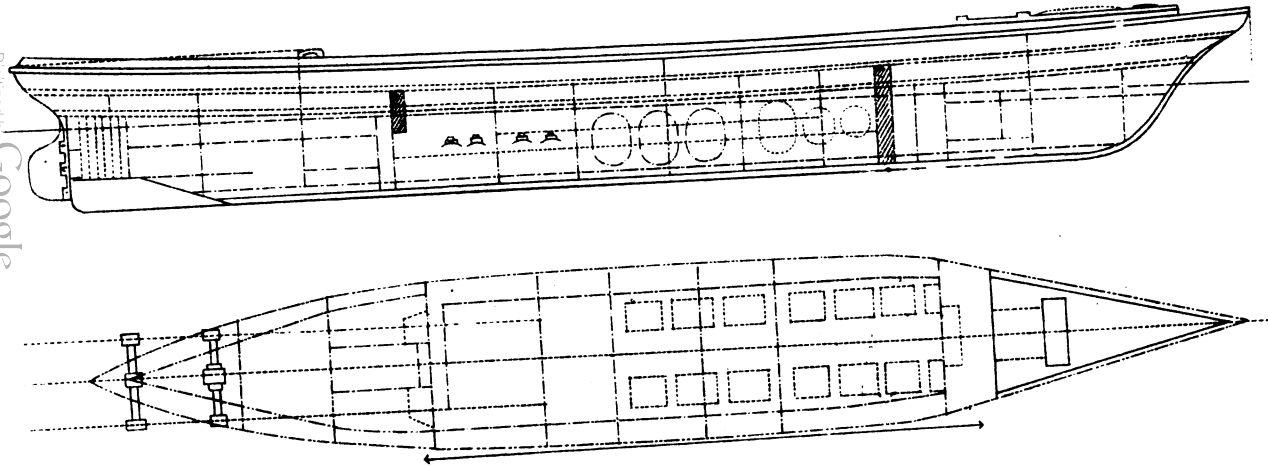
BRITISH SHIPS.

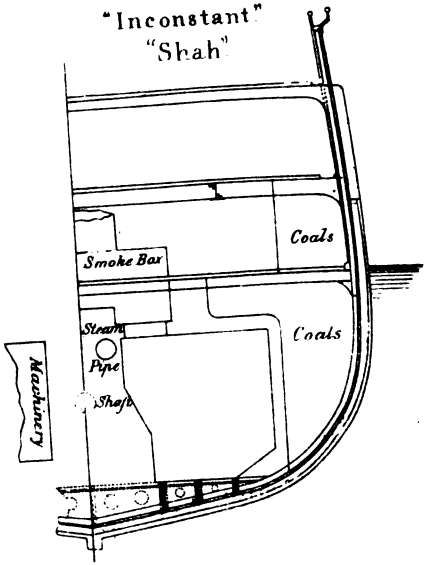
"Inconstant" & Shah.



"Iris" & "Mercury."



"Inconstant"
"Shah"



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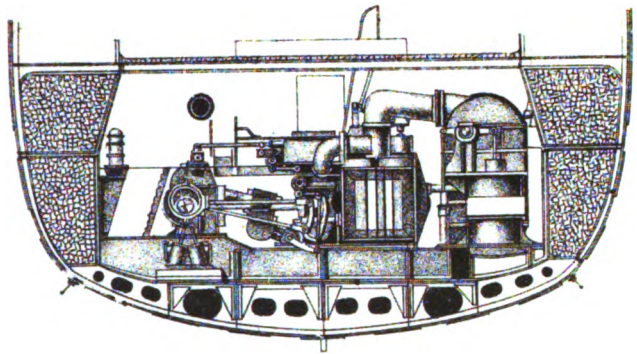
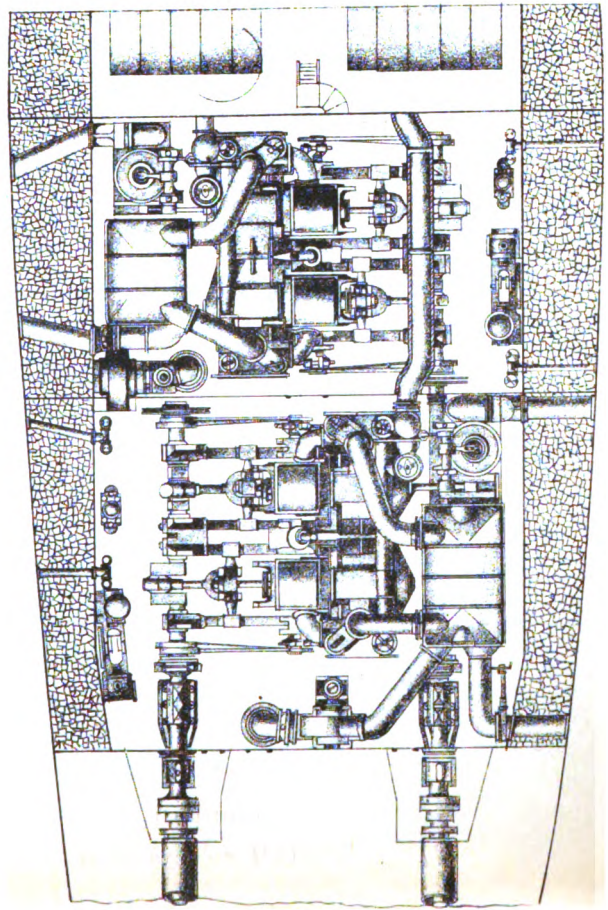
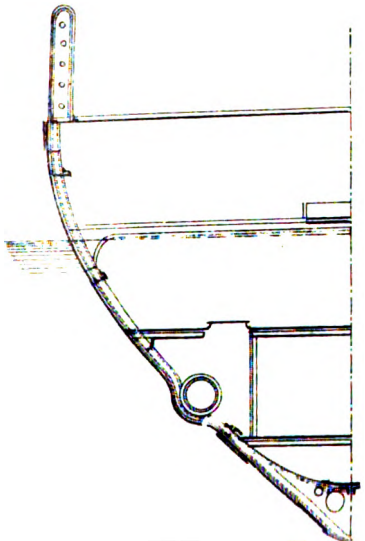
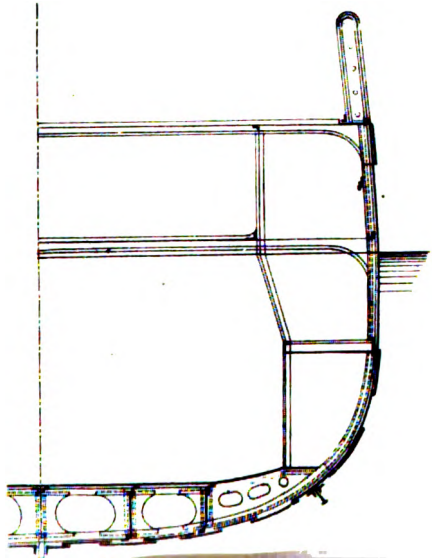
"Iris"









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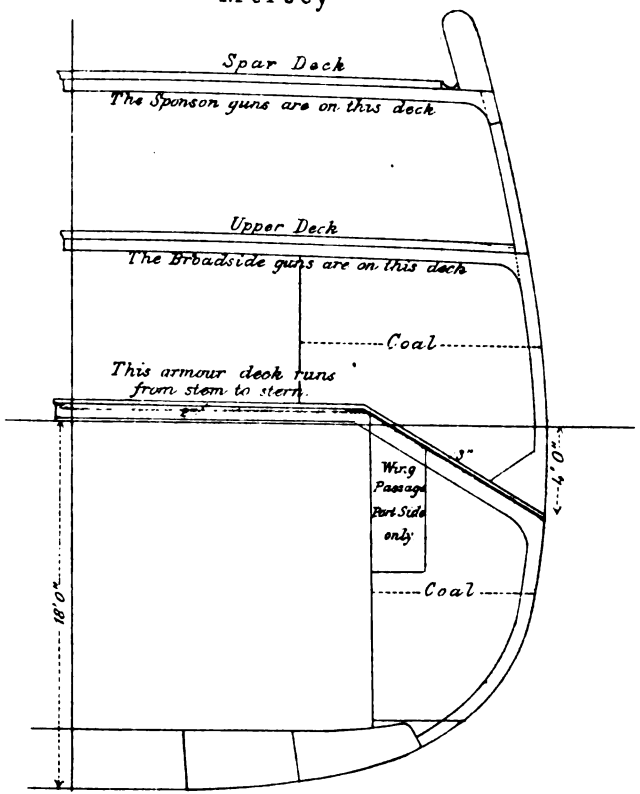
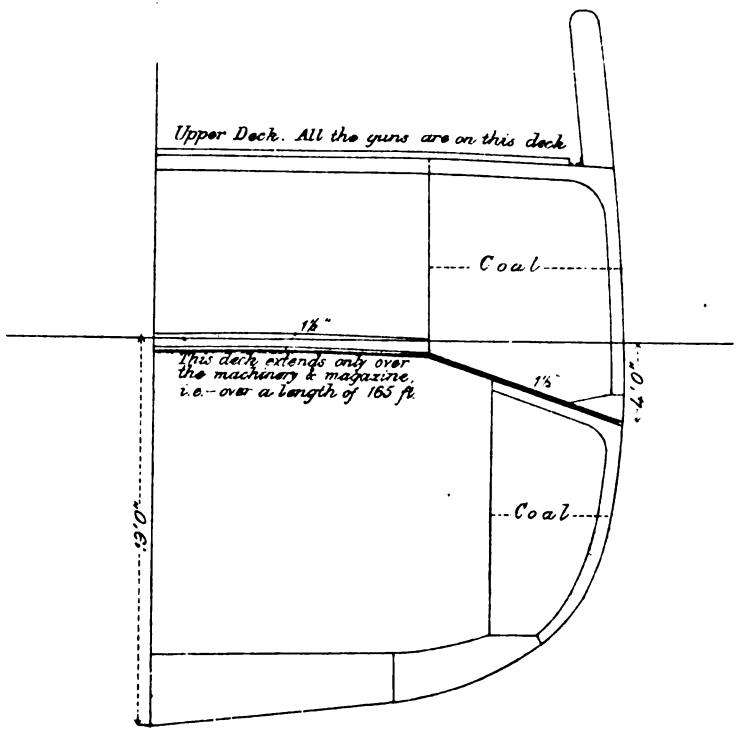
Midship Section of "Mersey"



Midship Section of "Leander"



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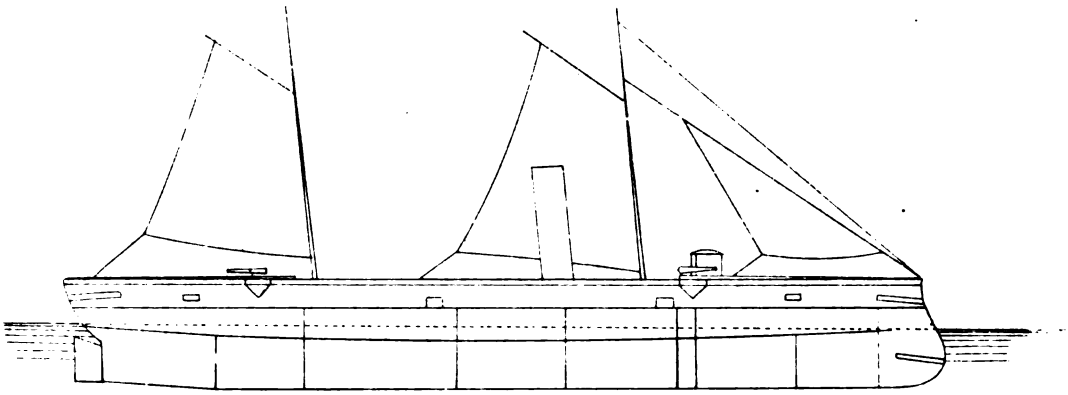
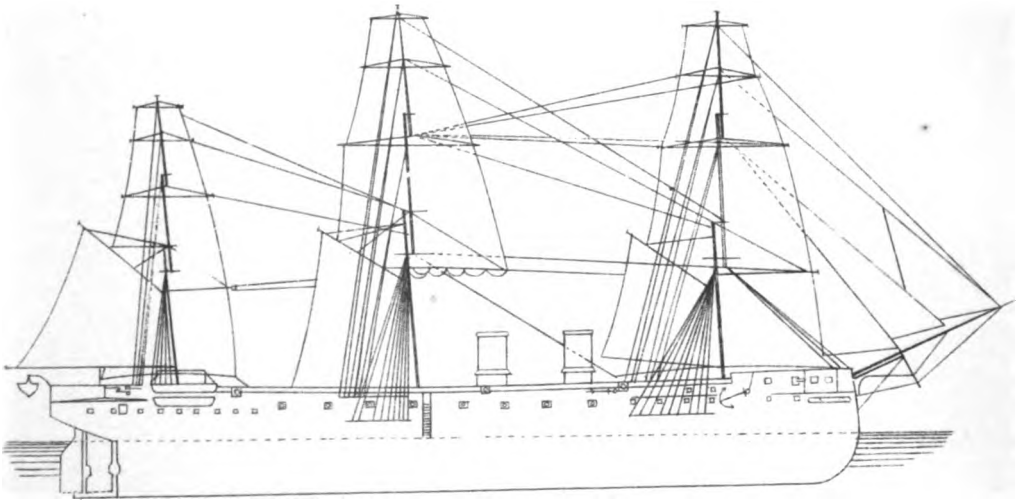
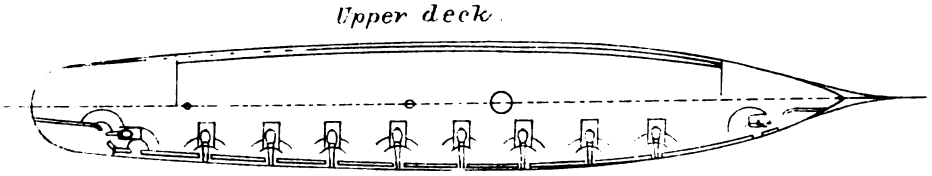
"Scout" & "Fearless"

Pl. 24.



"Shah" & "Inconstant"





HANHART LITH.

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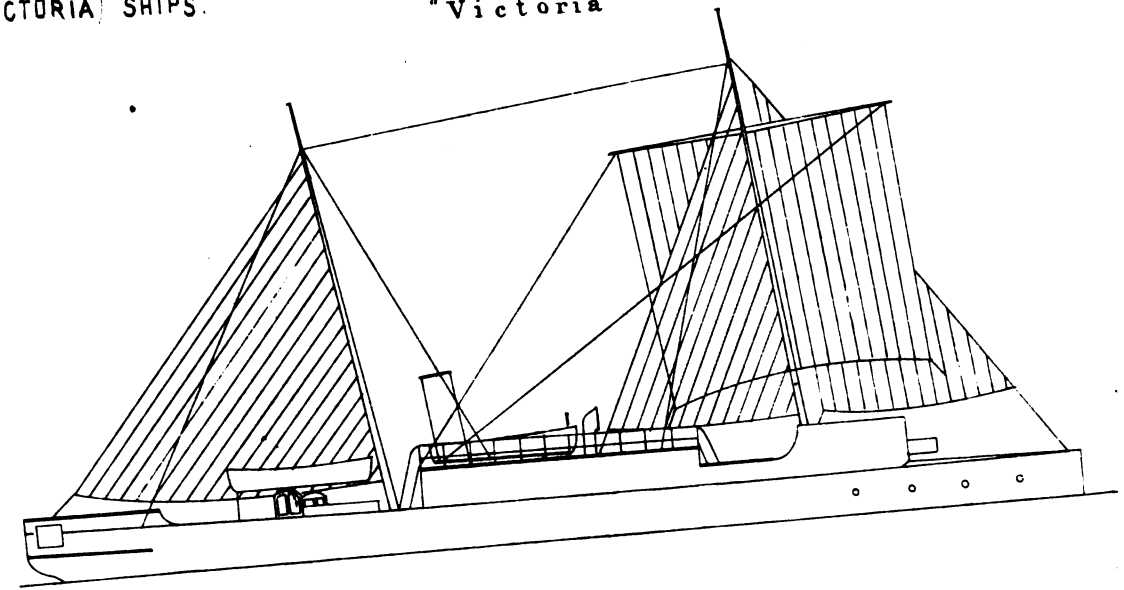
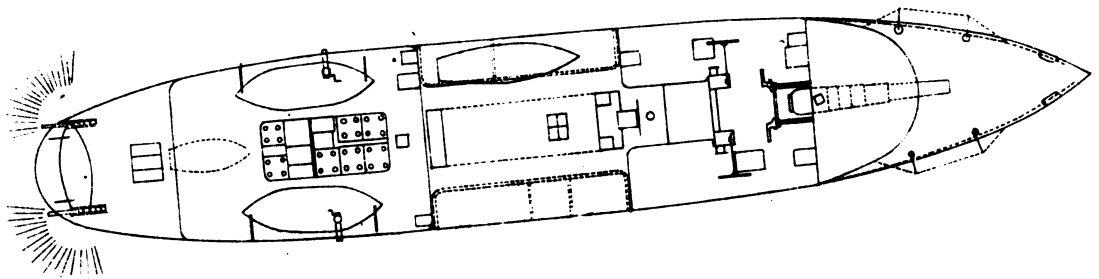
BRITISH COLONIAL (VICTORIA) SHIPS.

"Victoria"





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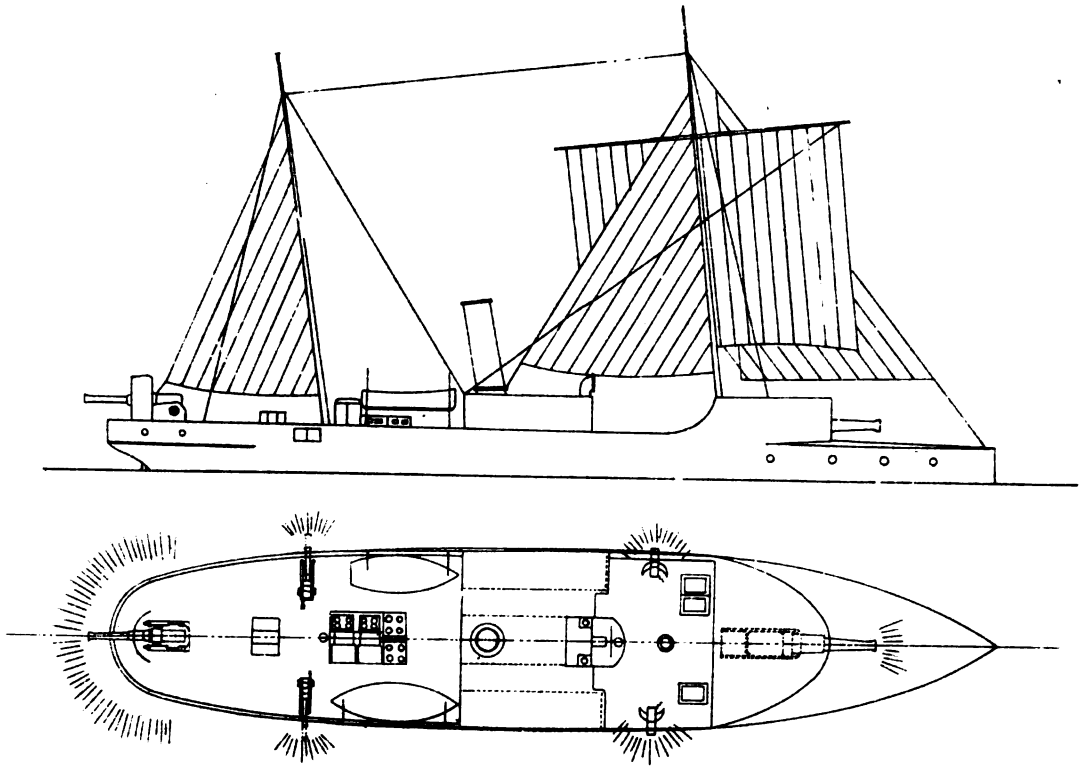
BRITISH COLONIAL (VICTORIA) SHIP.

"Albert"



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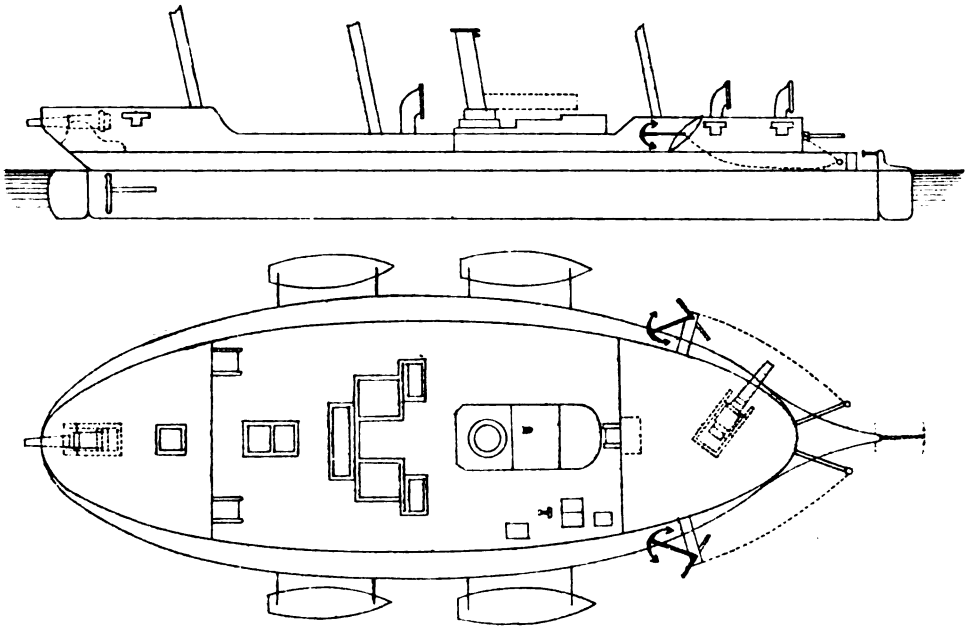
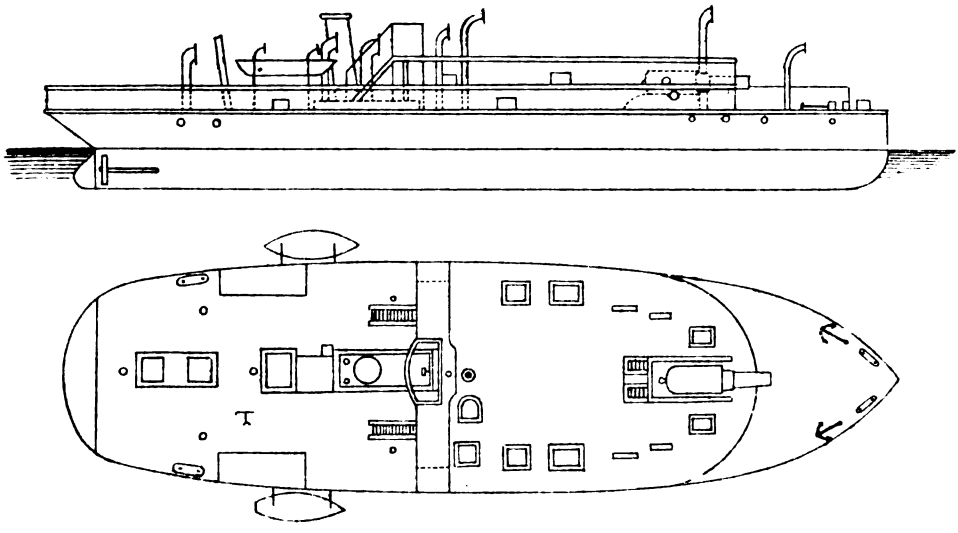
BRITISH SHIPS.

"Medina" *class.*



"Staunch" *class*



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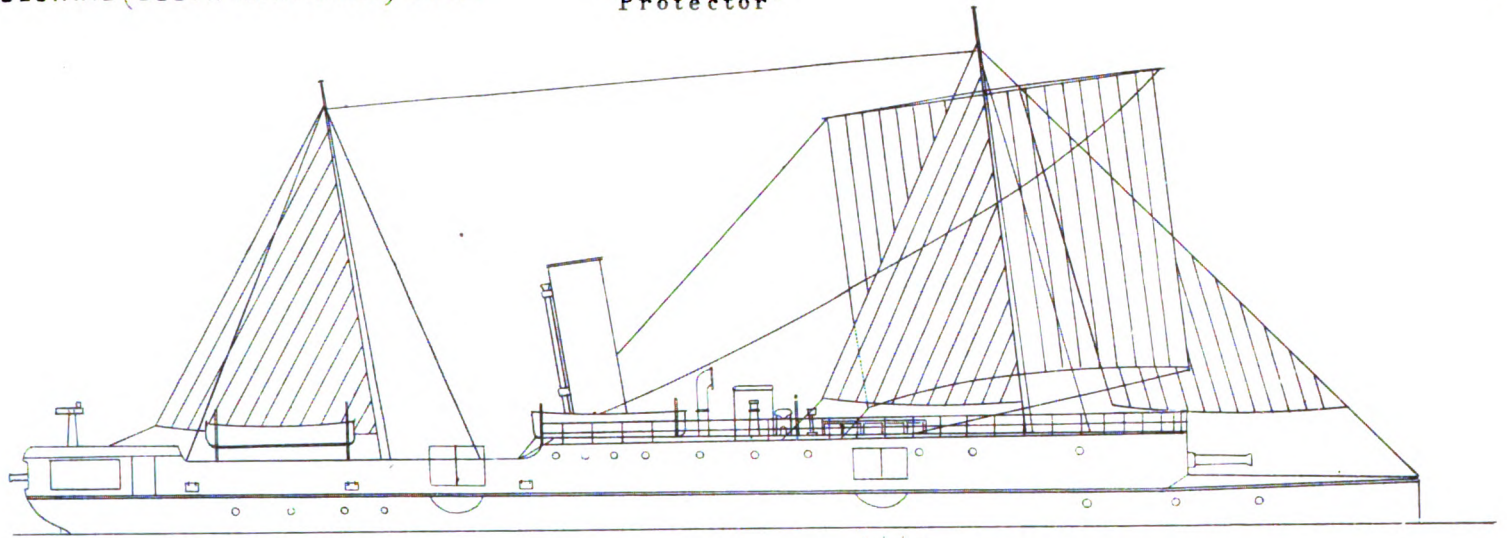
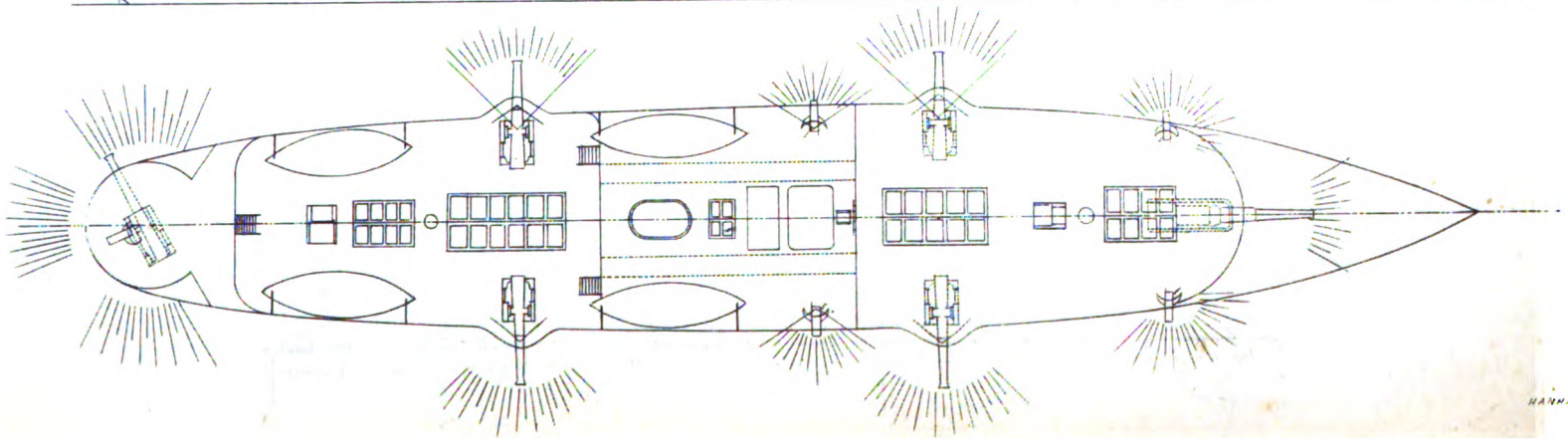
BRITISH COLONIAL (SOUTH AUSTRALIA) SHIP.

"Protector"

Pl. 28.





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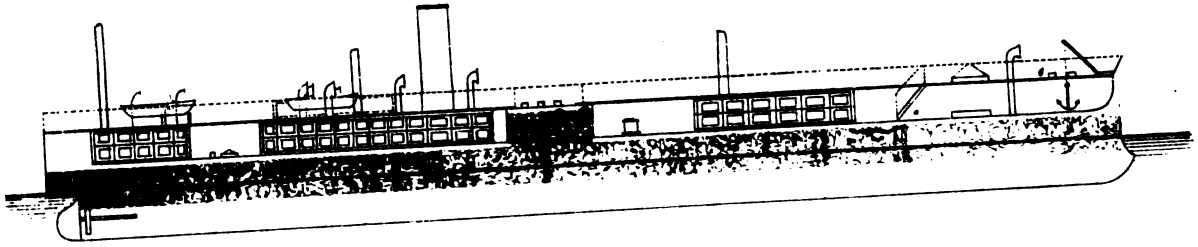
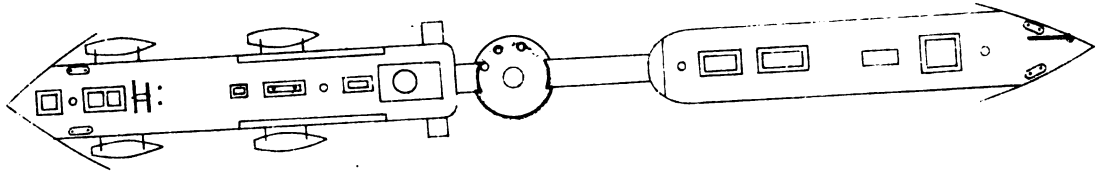
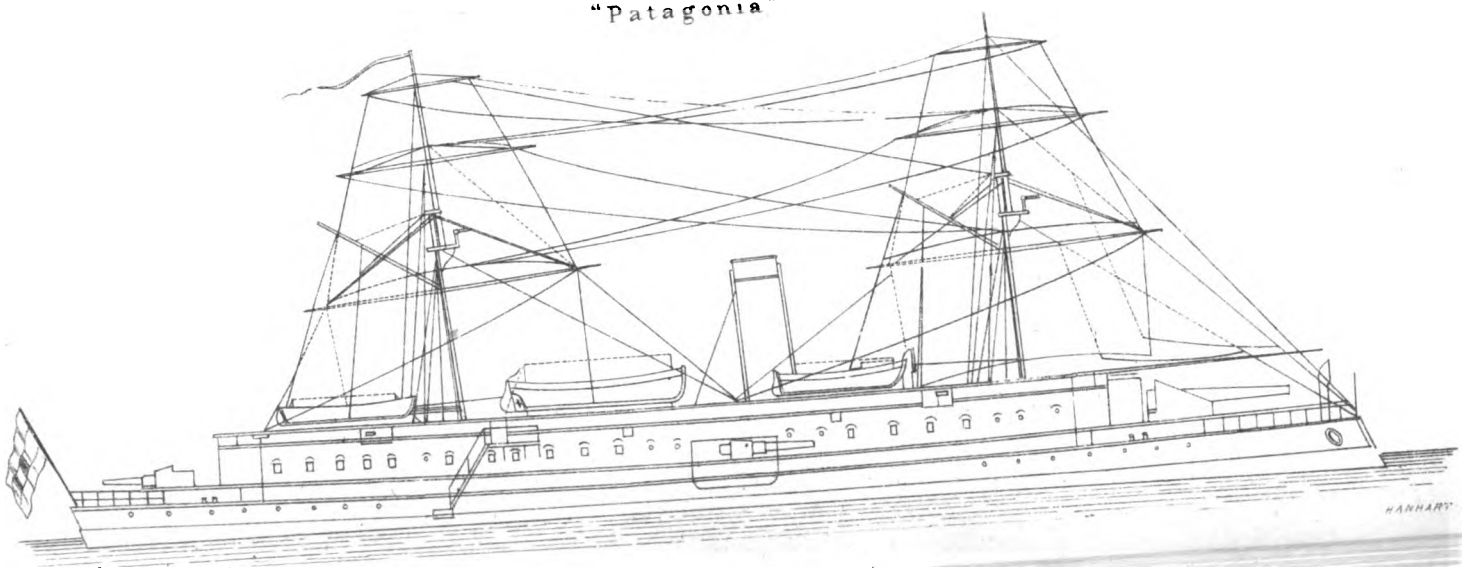




"Patagonia"



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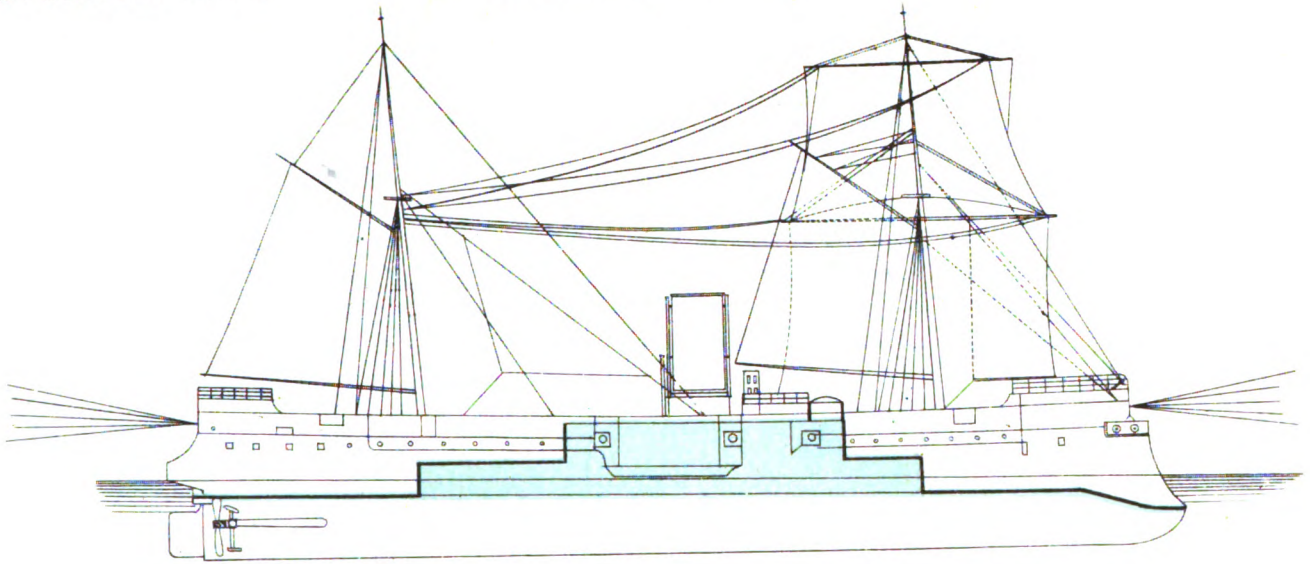
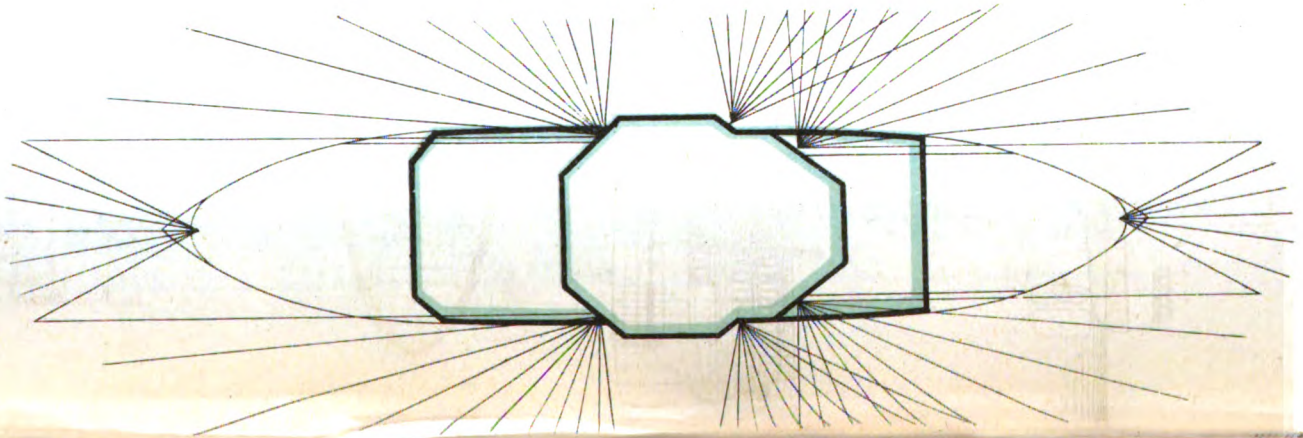
"Almirante Brown."





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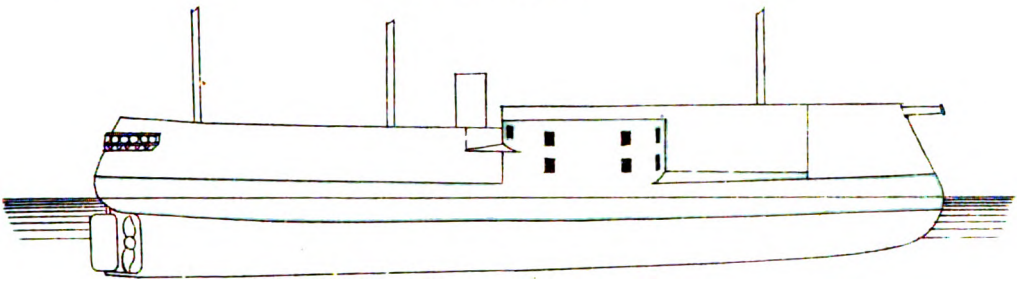
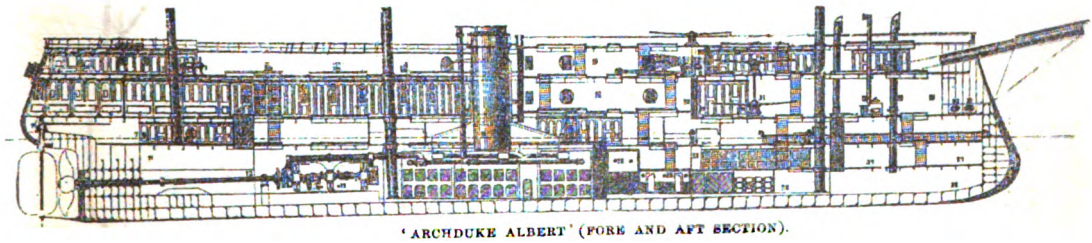
AUSTRIAN SHIPS.

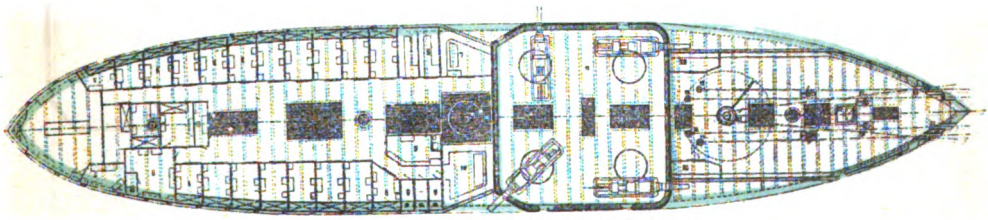
"Archduke Albert."



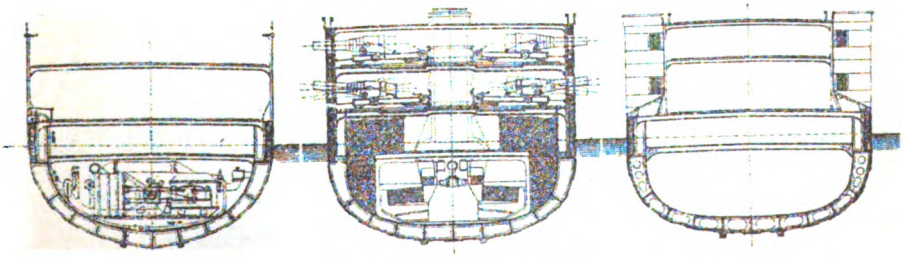
Figs. 186, 187, and 188.



'ARCHDUKE ALBERT' (FORE AND AFT SECTION).



'ARCHDUKE ALBERT' (MAIN DECK).



'ARCHDUKE ALBERT' (SECTION).

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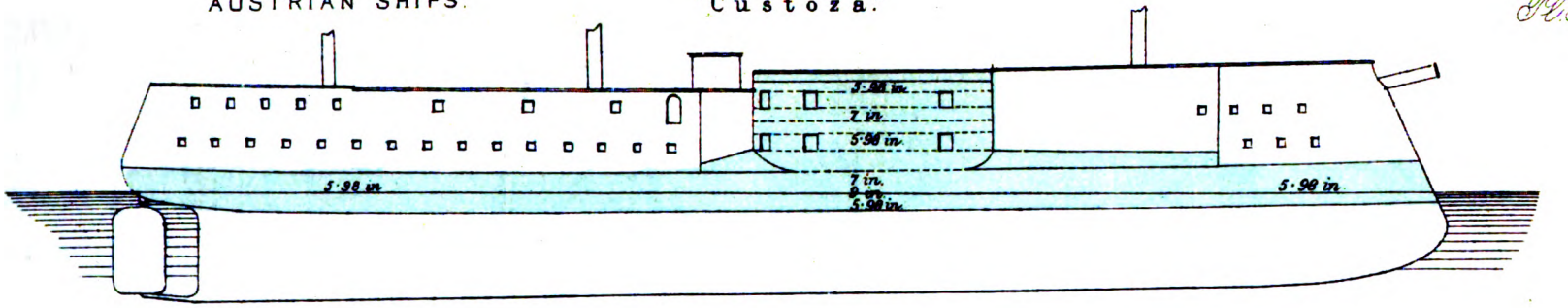
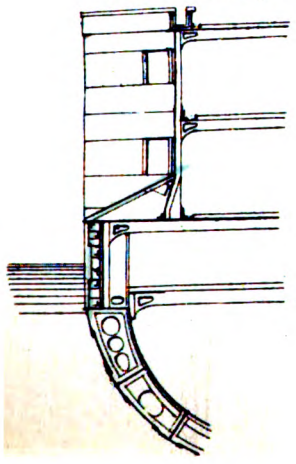
AUSTRIAN SHIPS.

"Custoza."

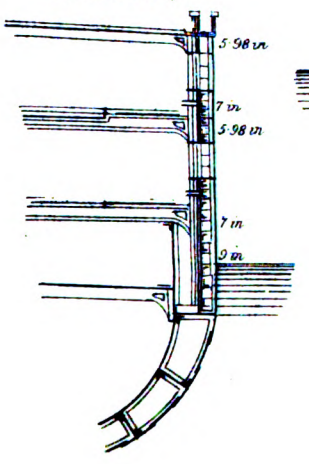


"Custoza."

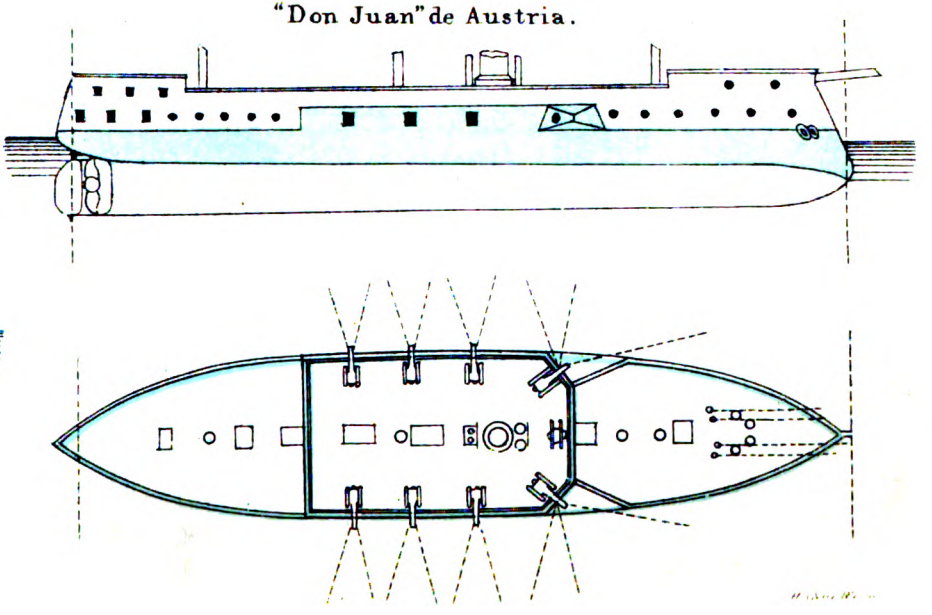
before the Battery.



in the Battery.



"Don Juan" de Austria.



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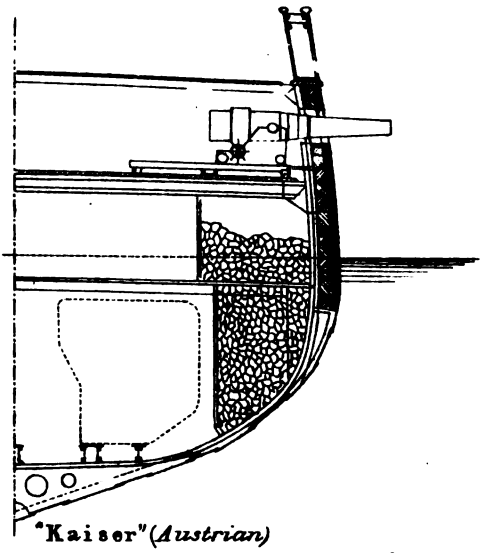
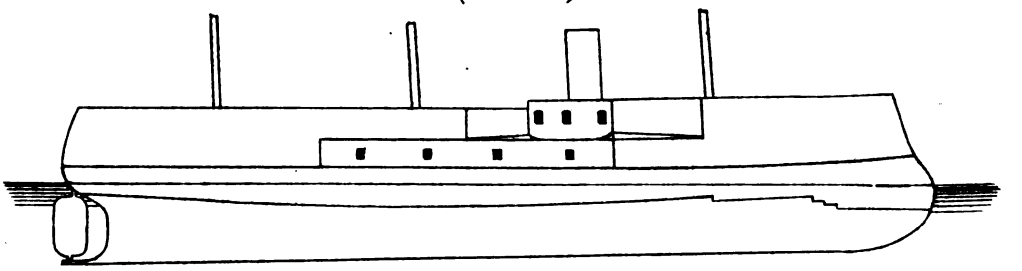
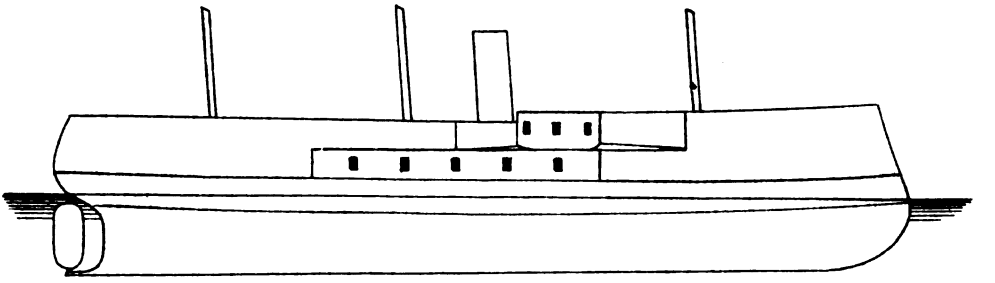
"Don Juan."
Section (as Rebuilt.)



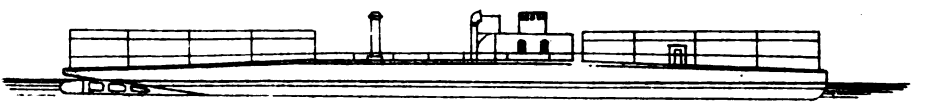
"Kaiser" *(Austrian)*

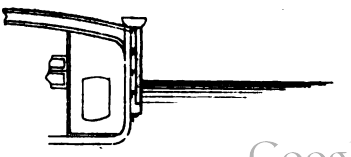


"Lissa."



"Leitha" & "Maros." *(River Monitors.)*





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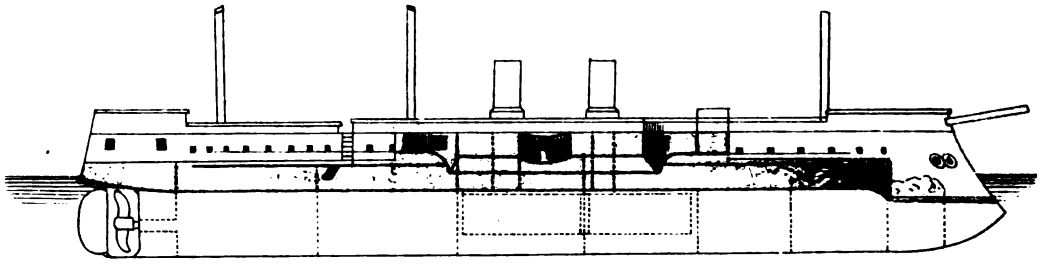
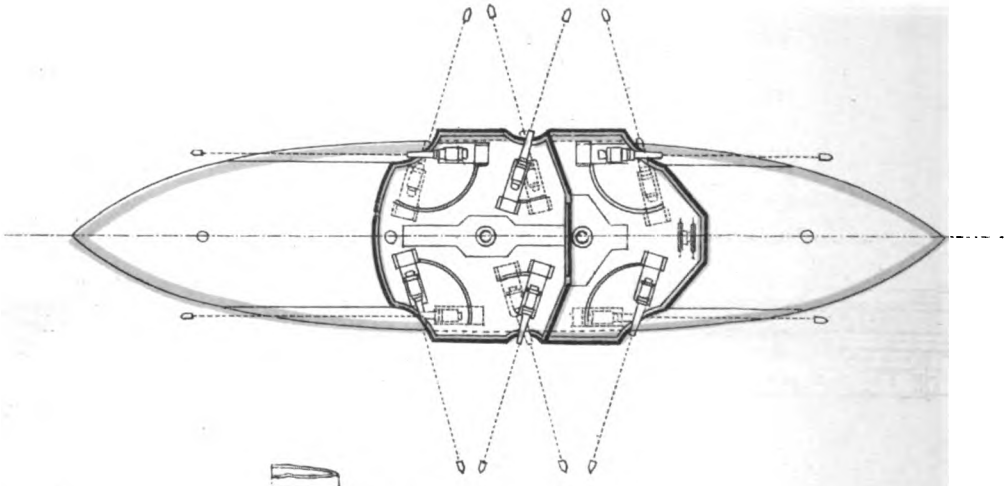
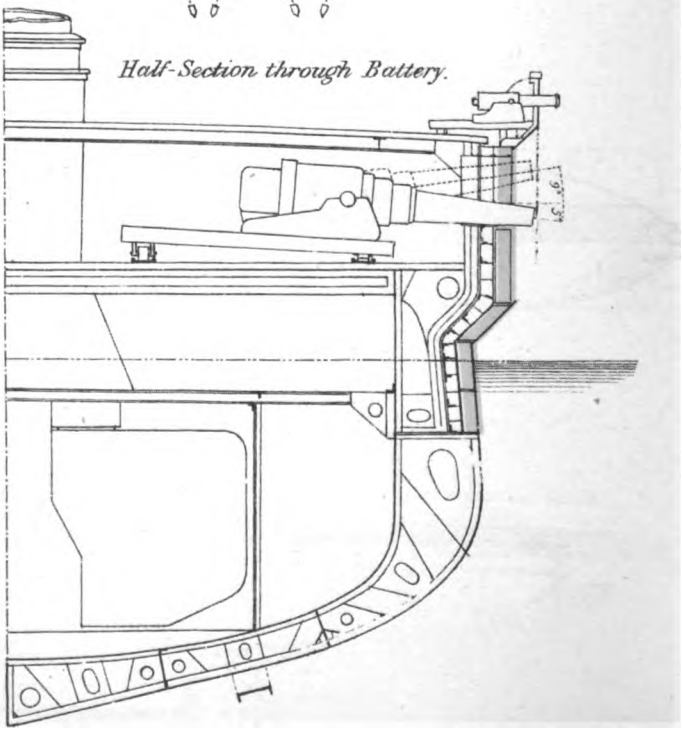
"Tegetthoff."







Half-Section through Battery.

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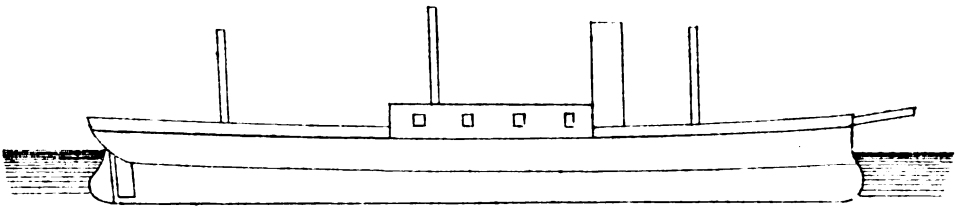
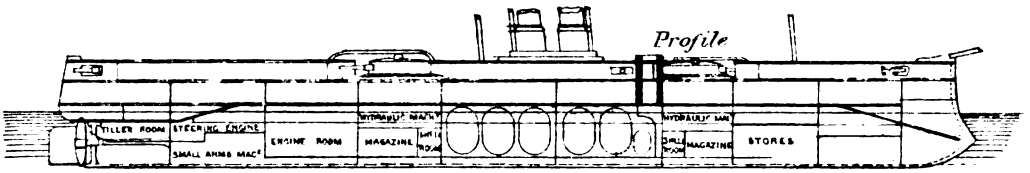
BRAZILIAN SHIPS.

"Brazil."

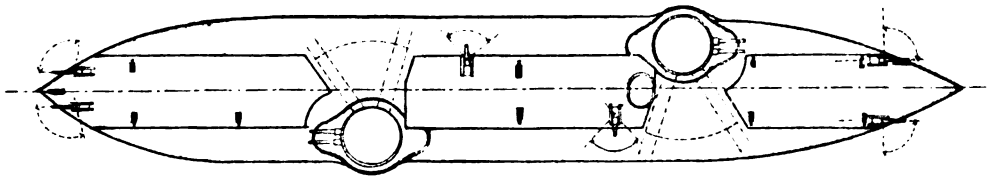


"Riachuelo."

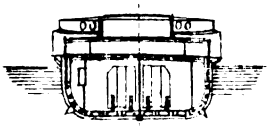
Profile



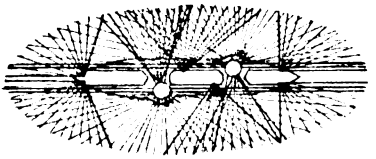
Plan of Upper Deck.



Midship Section.



Arc of Fire.



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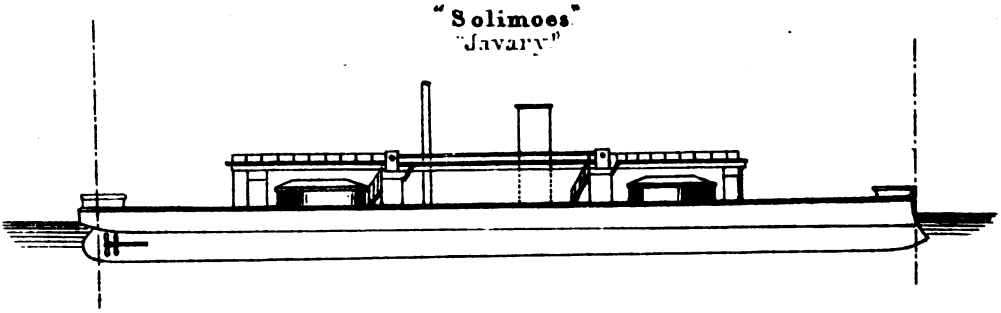
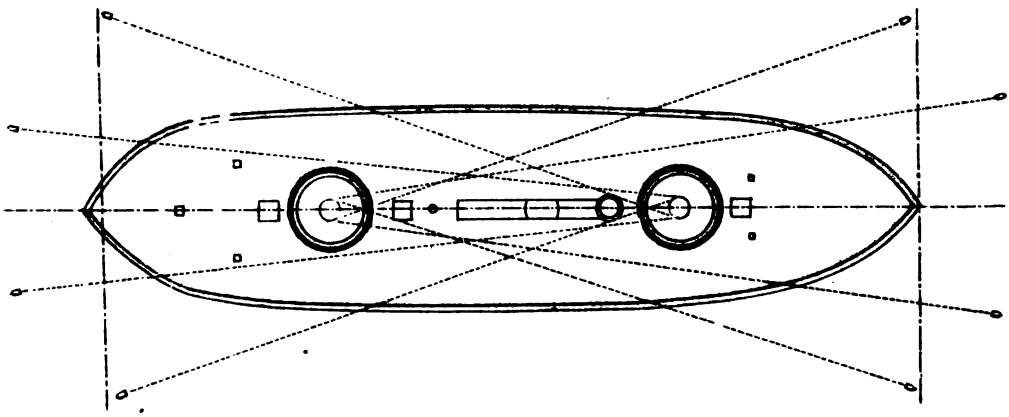
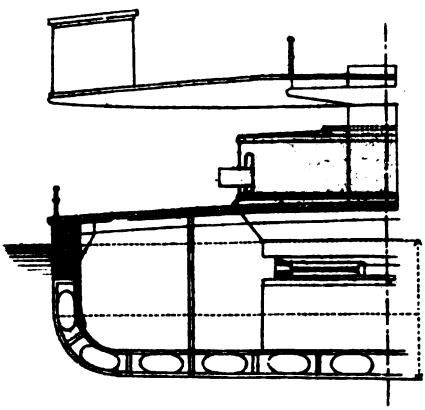
BRAZILIAN SHIPS.

"Solimoes"
"Javary"





Section.



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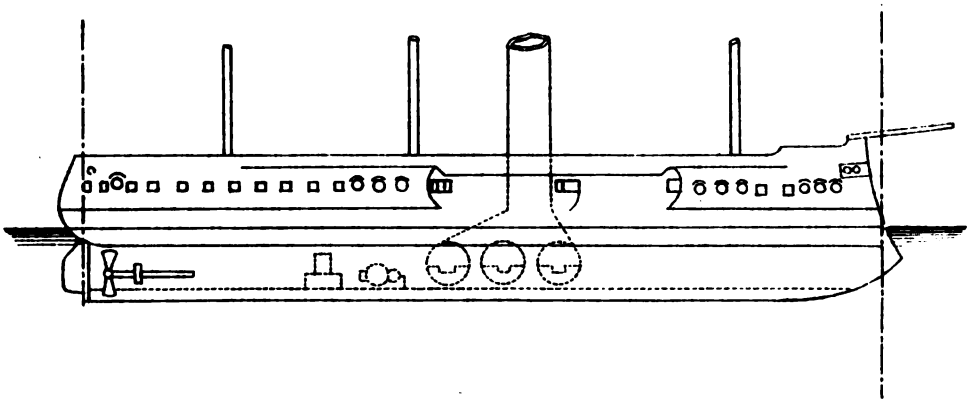
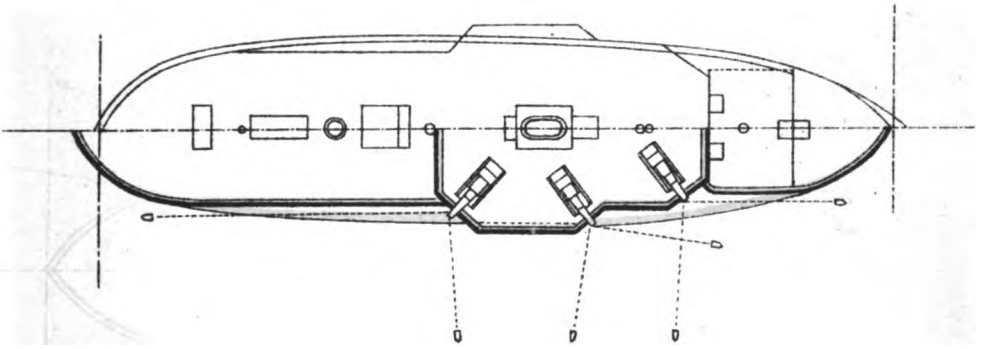
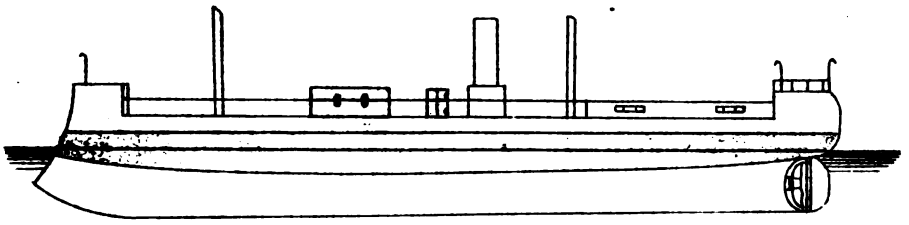
CHILIAN SHIPS.

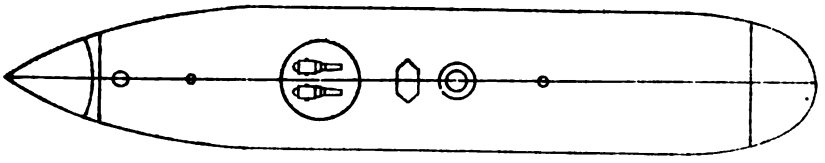
"Almirante Cochrane."
"Blanco Encalada."





"Huascar."





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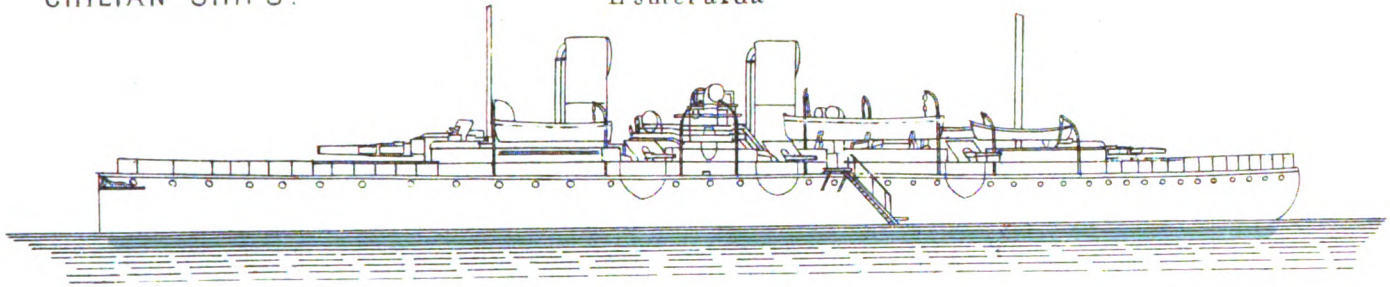
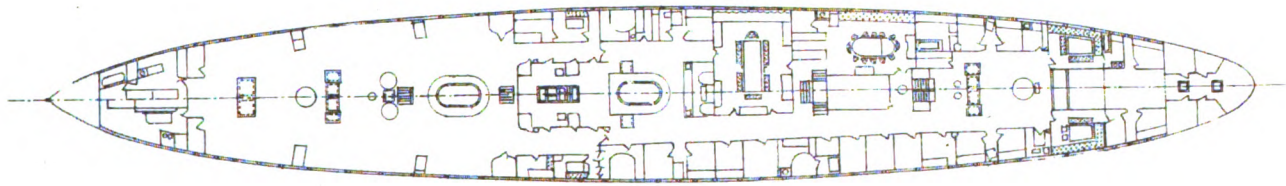
9238.

CHILIAN SHIPS.

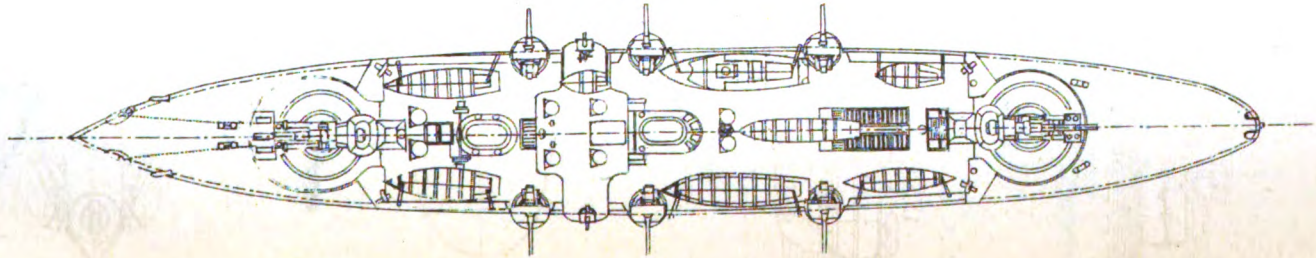
"Esmeralda"



Main Deck.



Upper Deck



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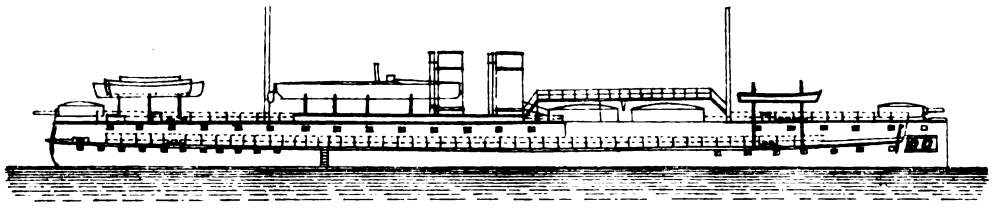
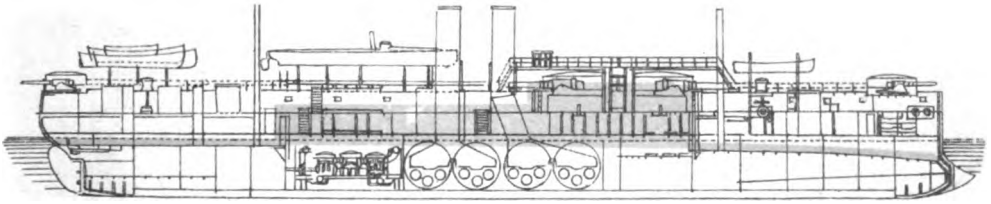
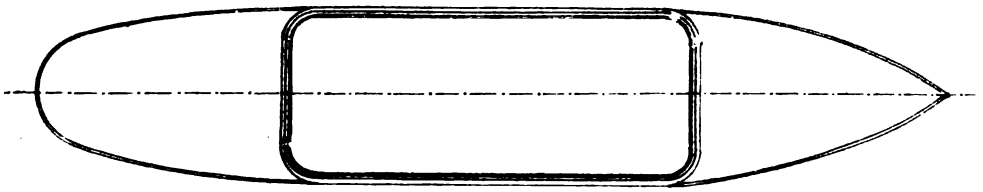
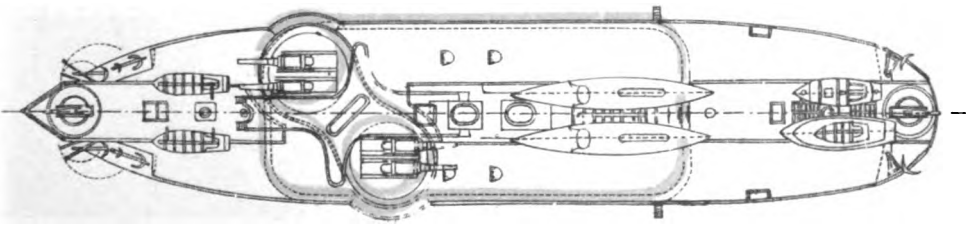
"Ting Yuen" & "Chen Yuen."









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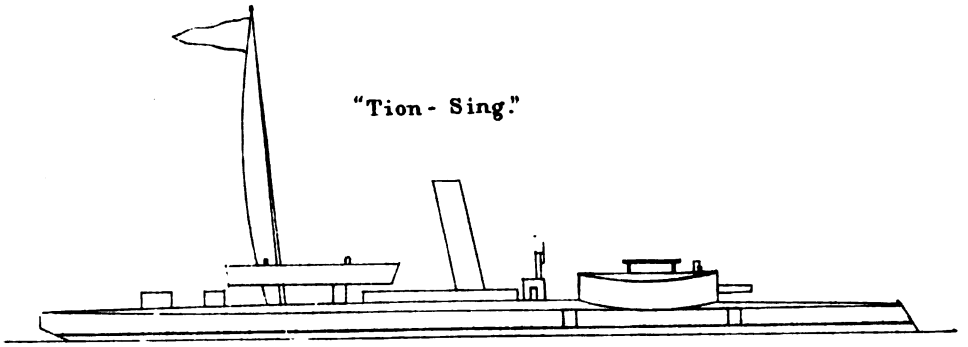
CHINESE SHIPS.



"Tion-Sing."

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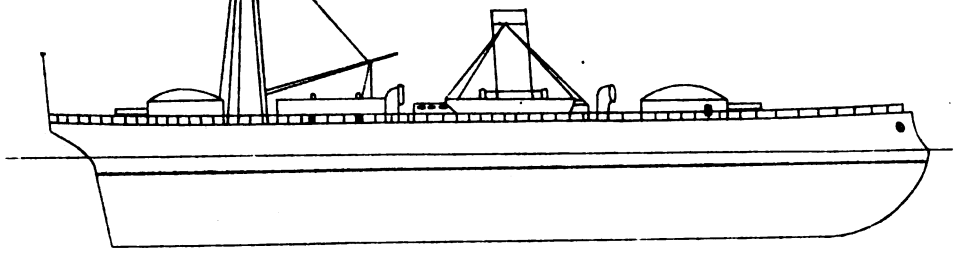
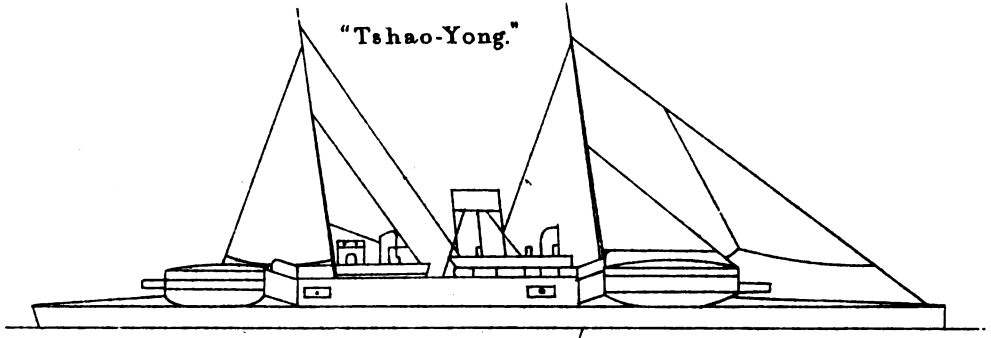
CHINESE SHIPS.

"Tshi-Yuen."



"Tshao-Yong."



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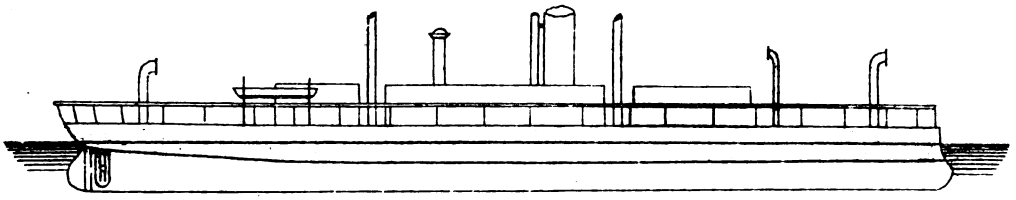
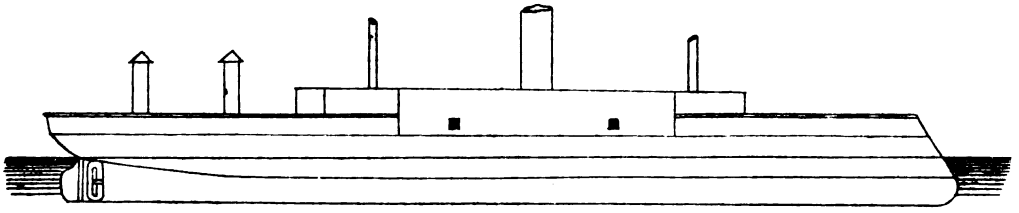
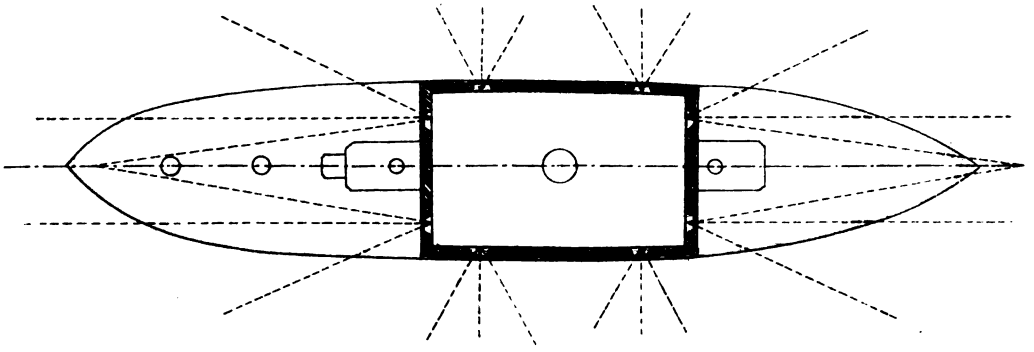
"Gorm".

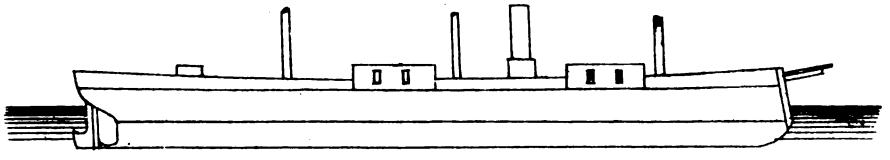


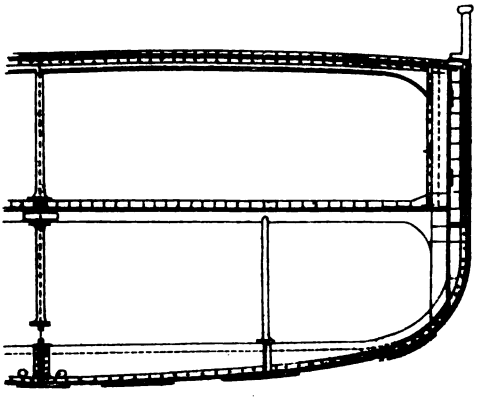
"Odin".





"Rolf Krake".





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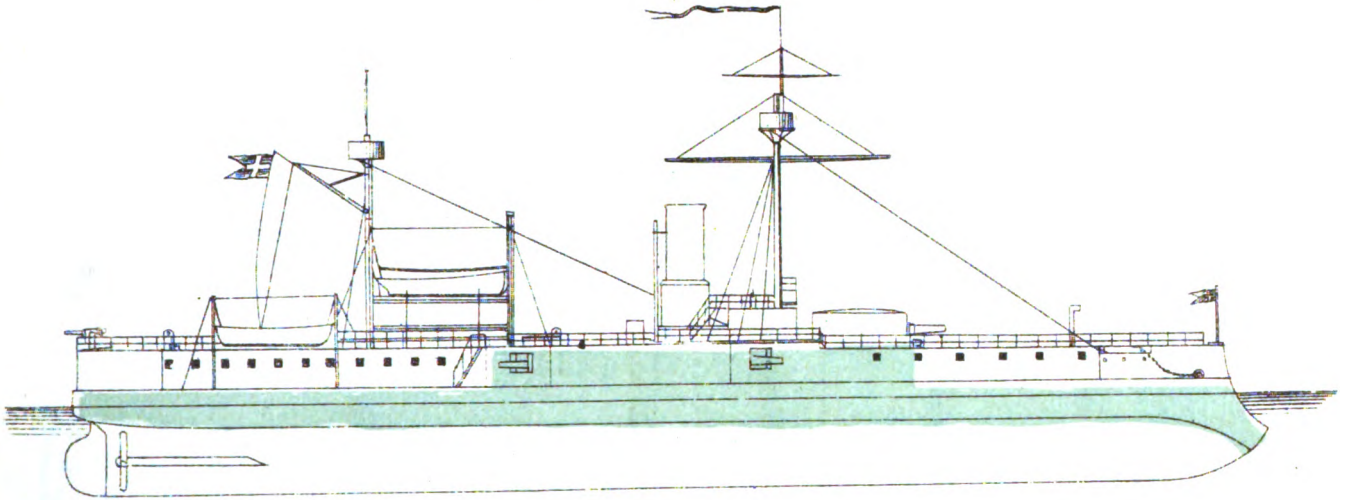
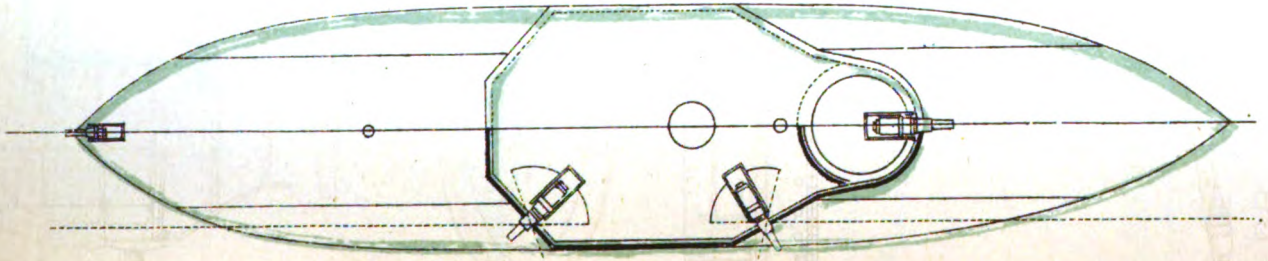
"Helgoland."





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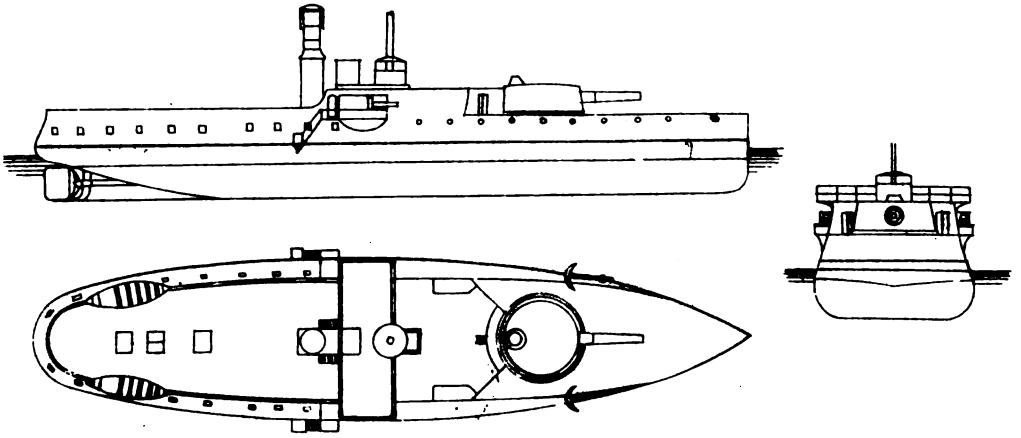
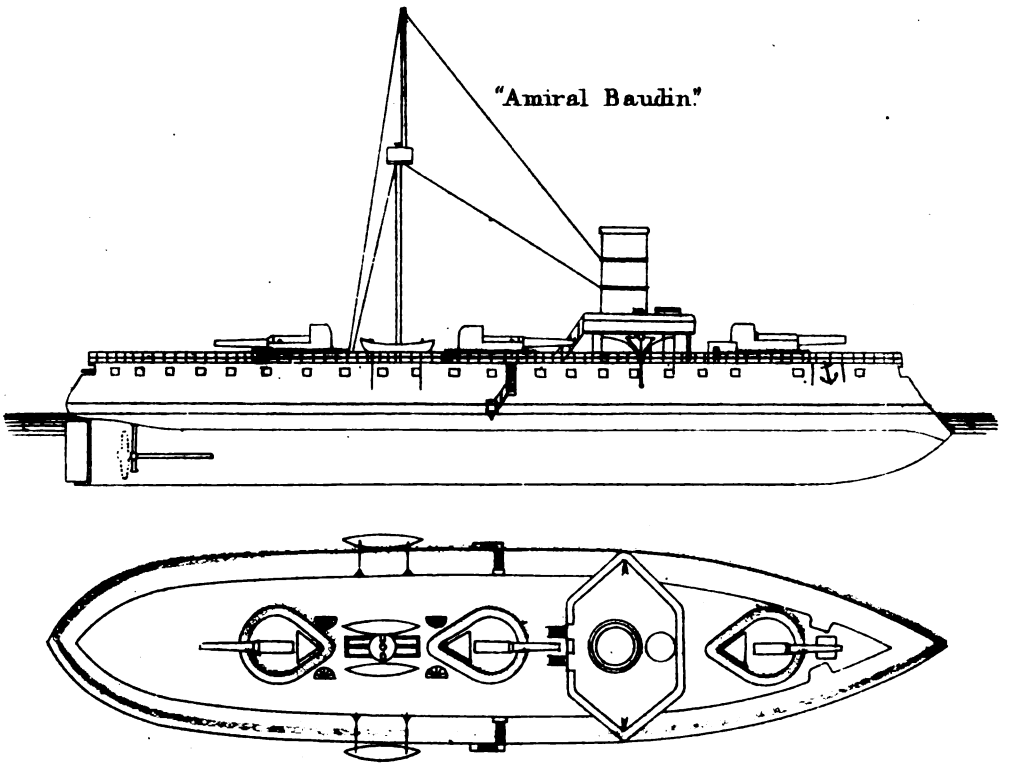
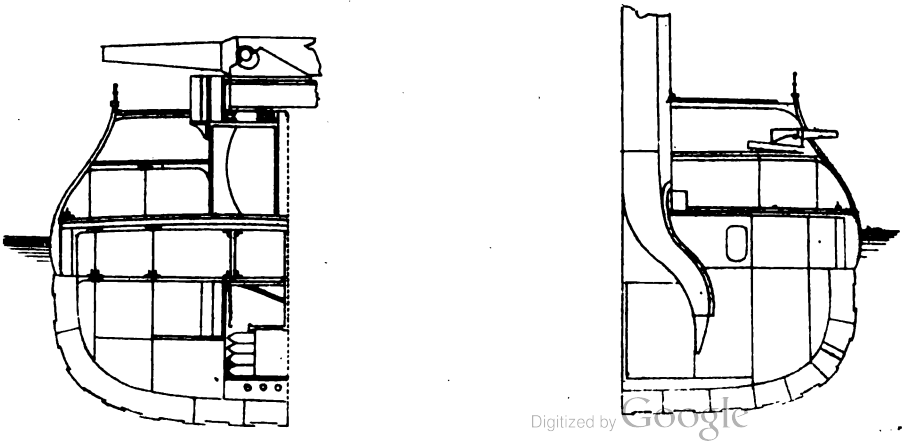
"Achéron"



"Amiral Baudin."





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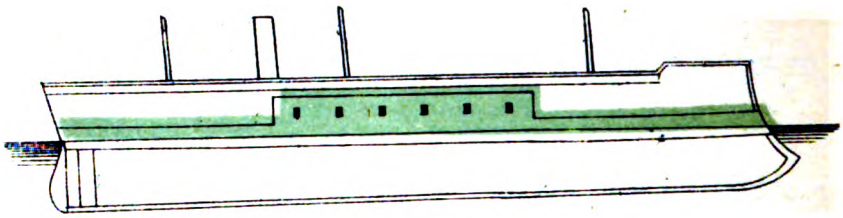
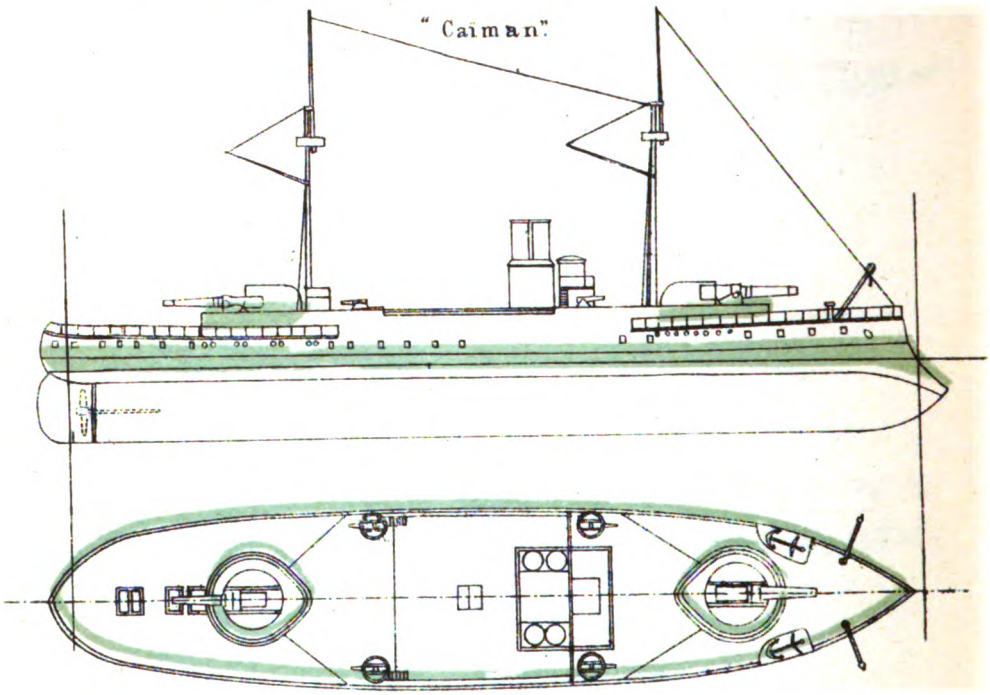
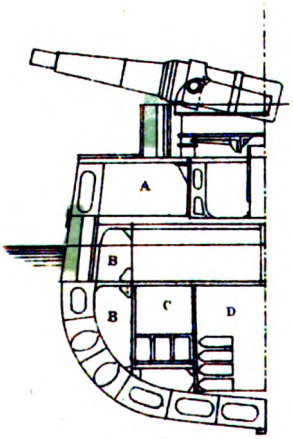
FRENCH SHIPS.

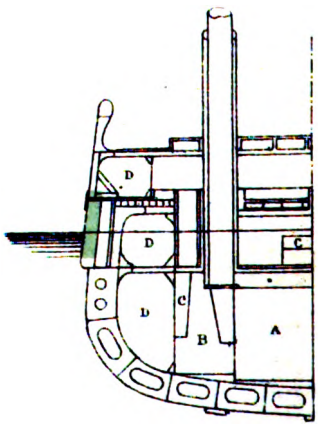
"Belliqueuse."



"Caiman."







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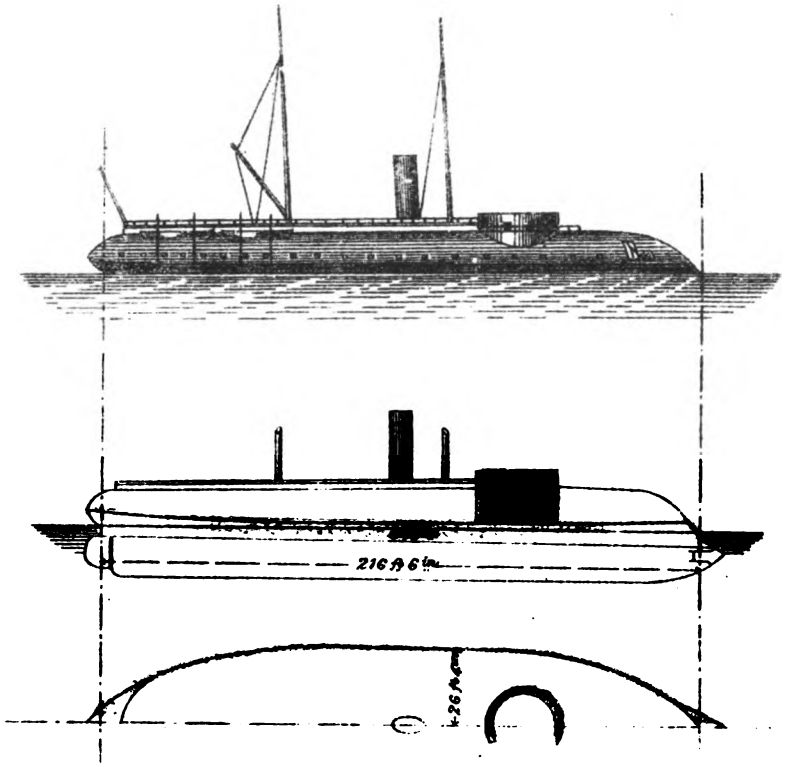
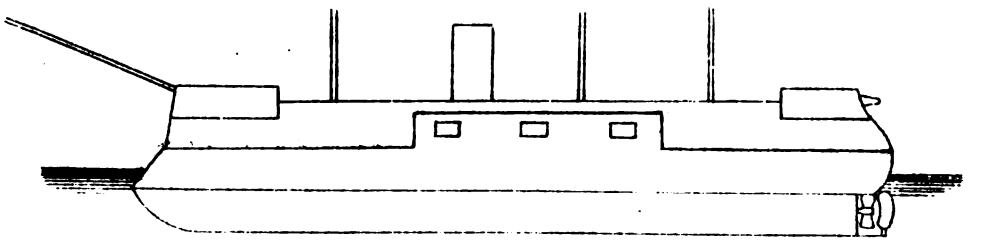
Cerbere



"Colbert."



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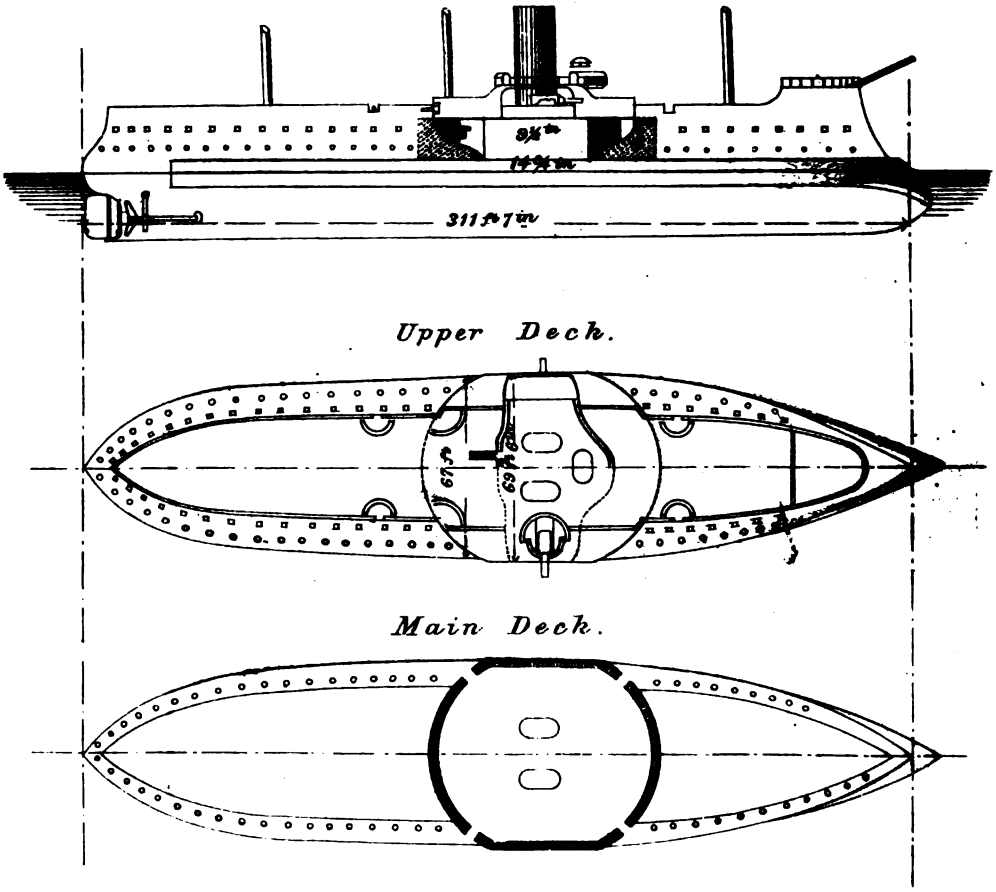
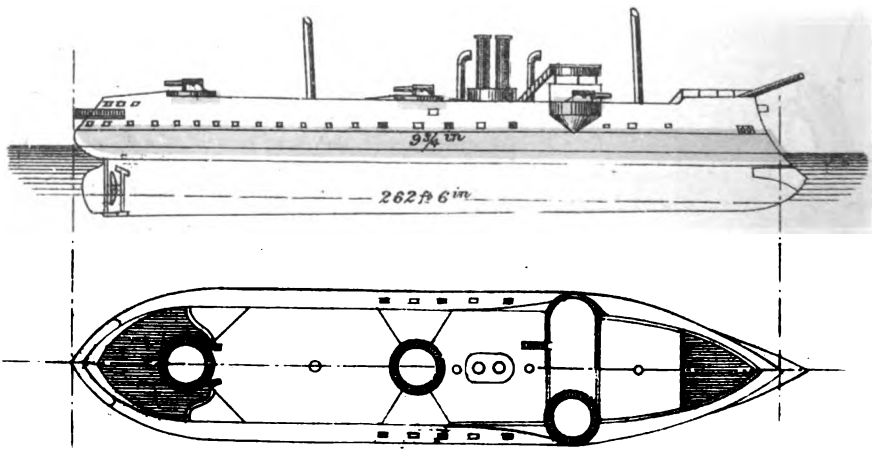
Dévastation.



Duguesclin.



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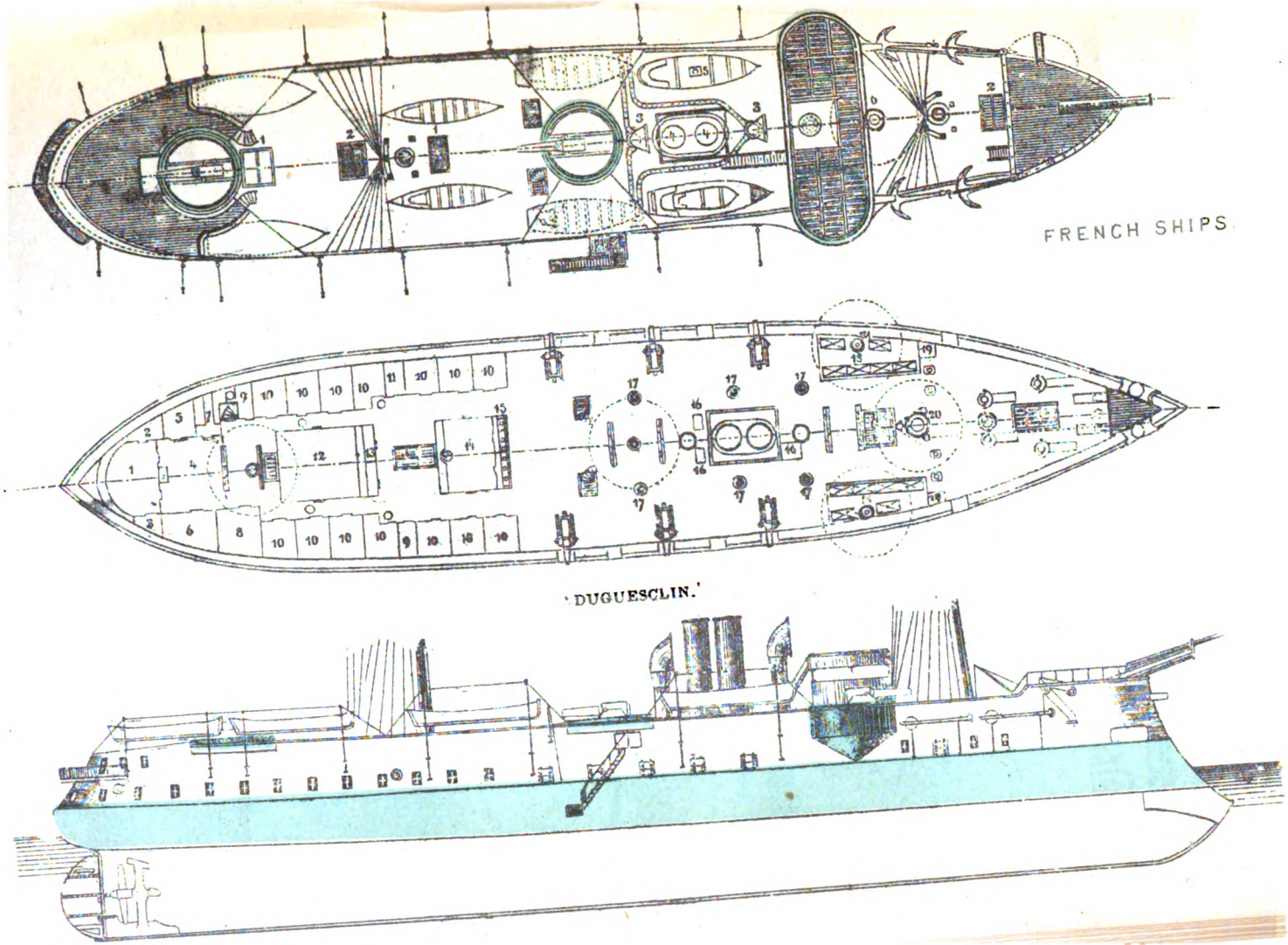

'DUGUESCLIN.'

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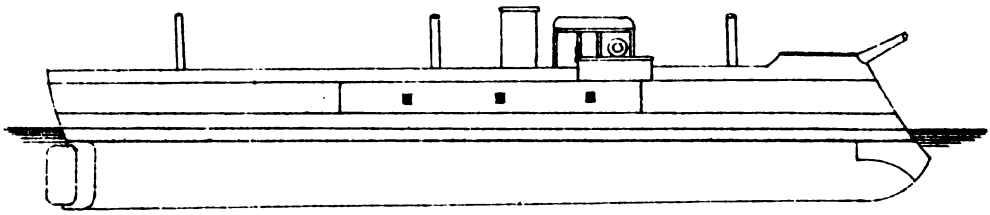
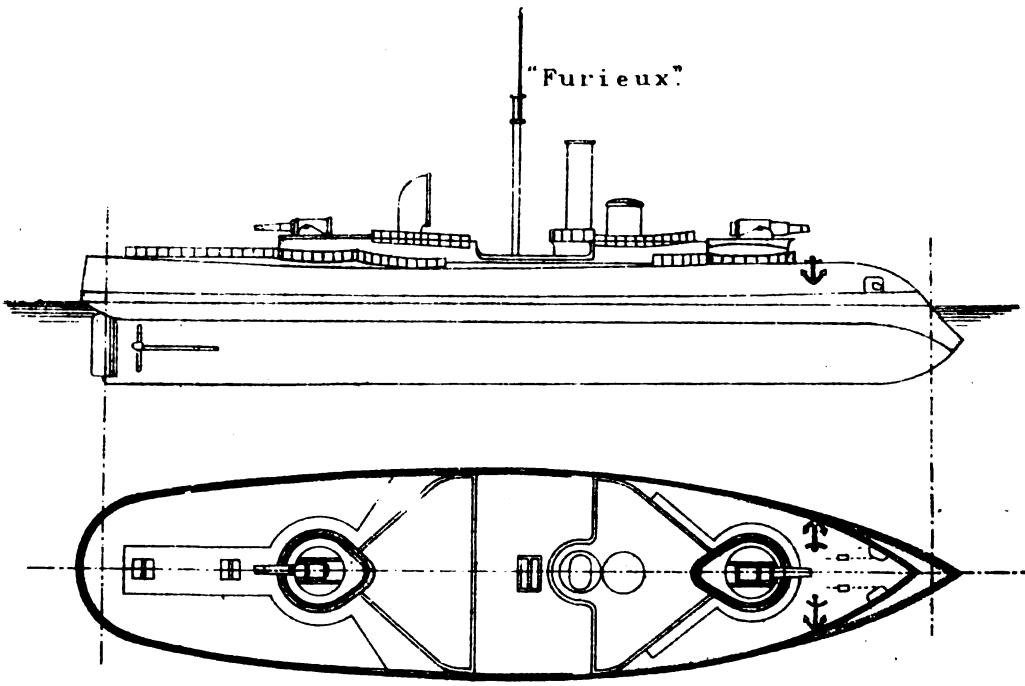
FRENCH SHIPS.

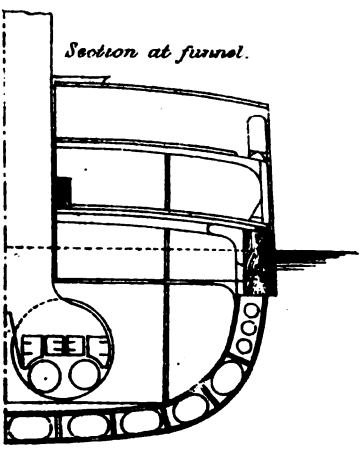
"Friedland."



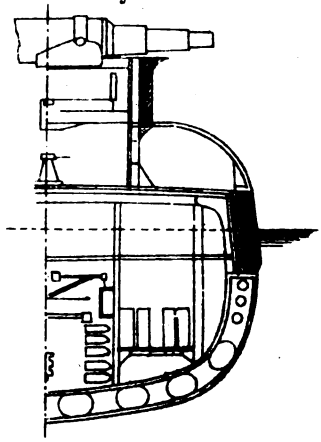
"Furieux."



Section at funnel.



Section at foremast.



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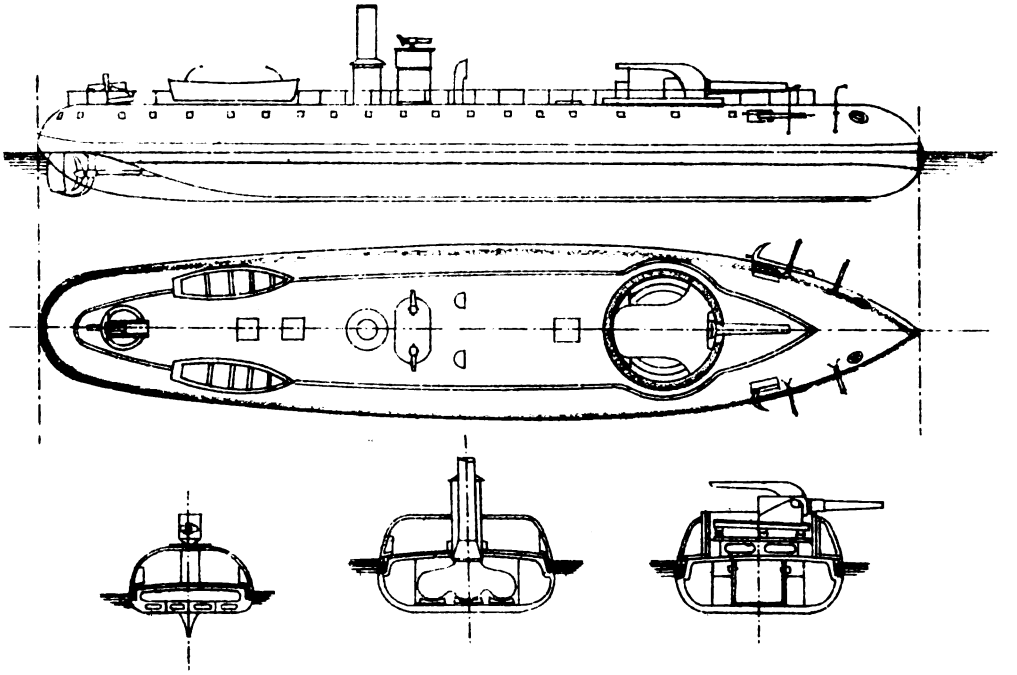
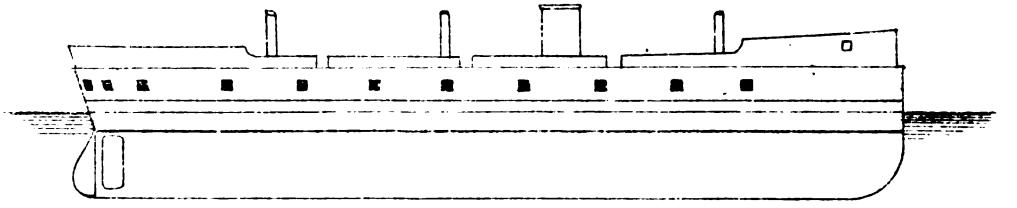
FRENCH SHIPS.

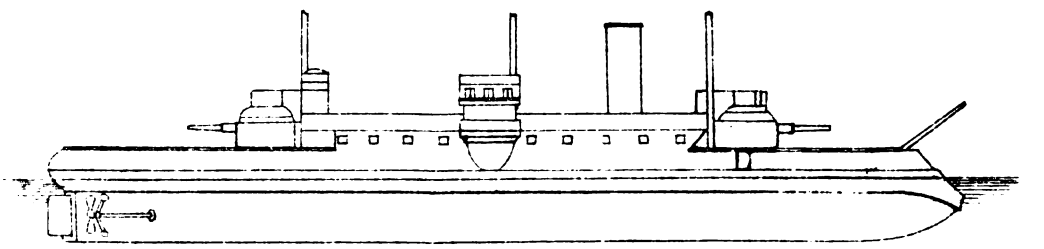
"Fusée." *Class.*

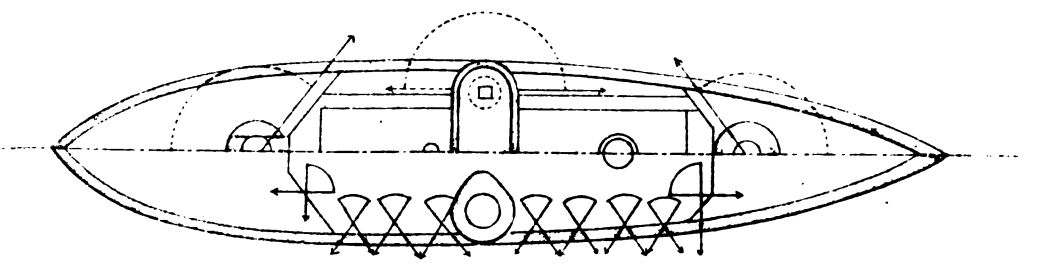


"Heroine."



"Hoche."





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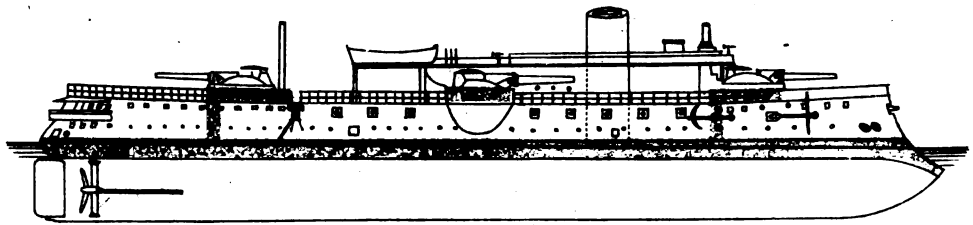
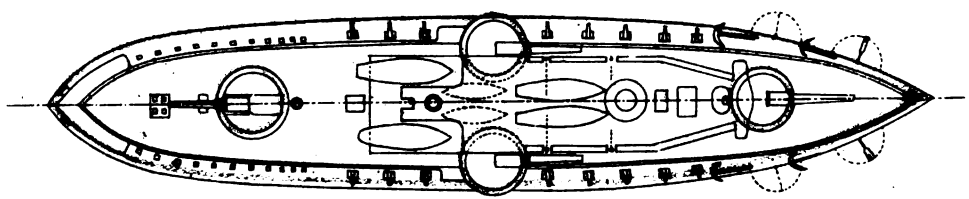
FRENCH SHIPS.

"Magenta."





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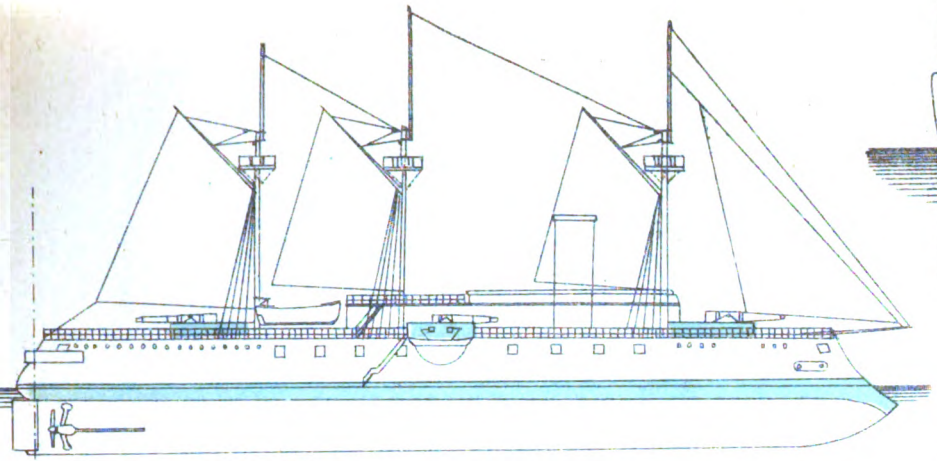
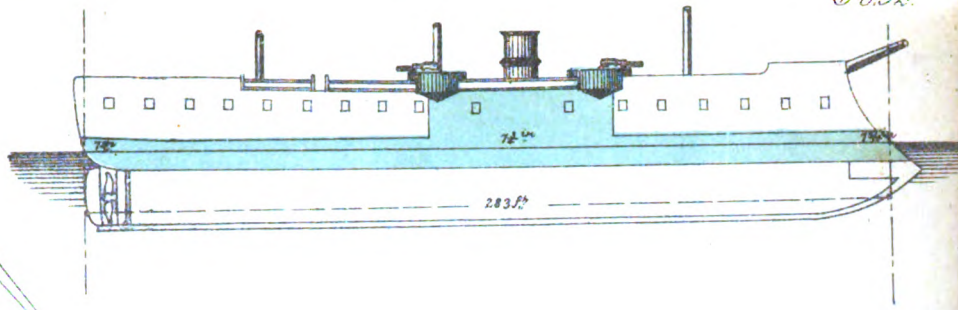
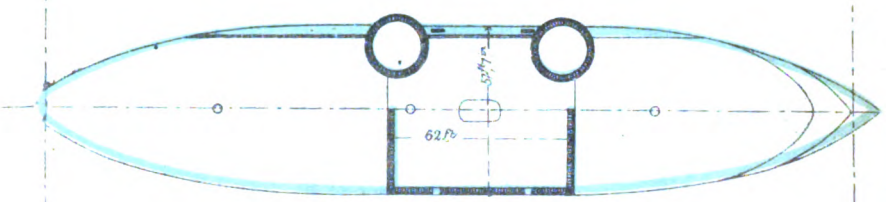
"Marceau." FRENCH SHIPS. "Ocean" Class.

Pl. 52.





Upper Deck.



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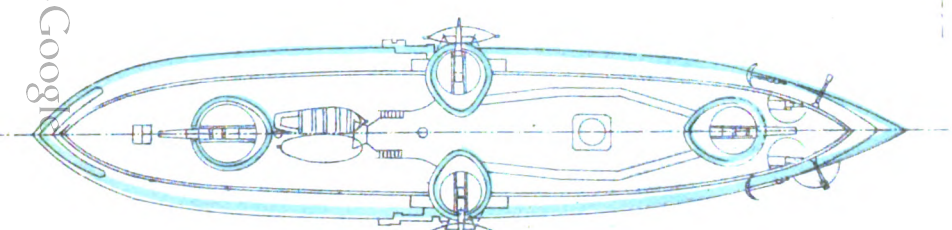

HANHART LITH.

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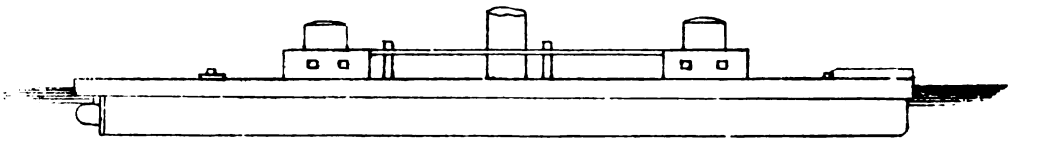
"Onondaga."



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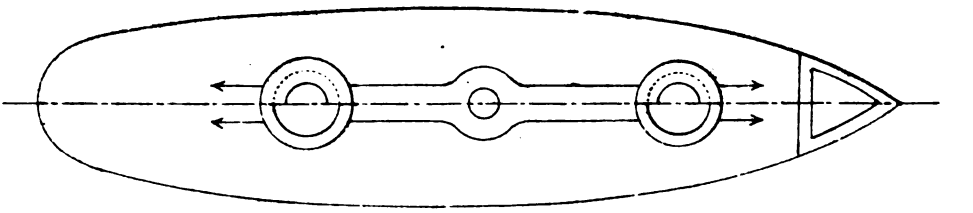
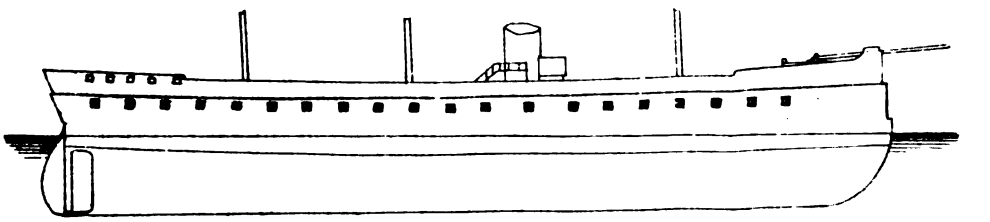
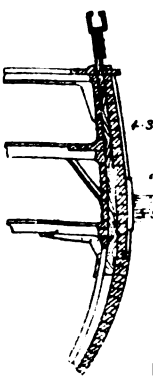


"Onondaga."

"Provence."





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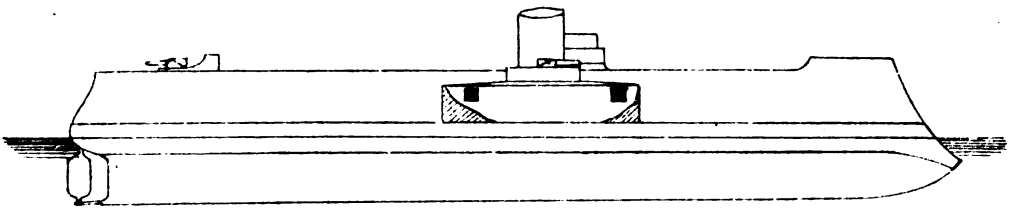
FRENCH SHIPS

"Redoutable"



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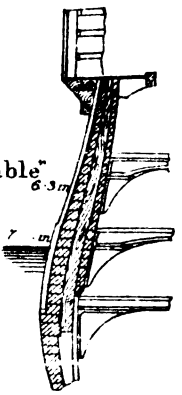
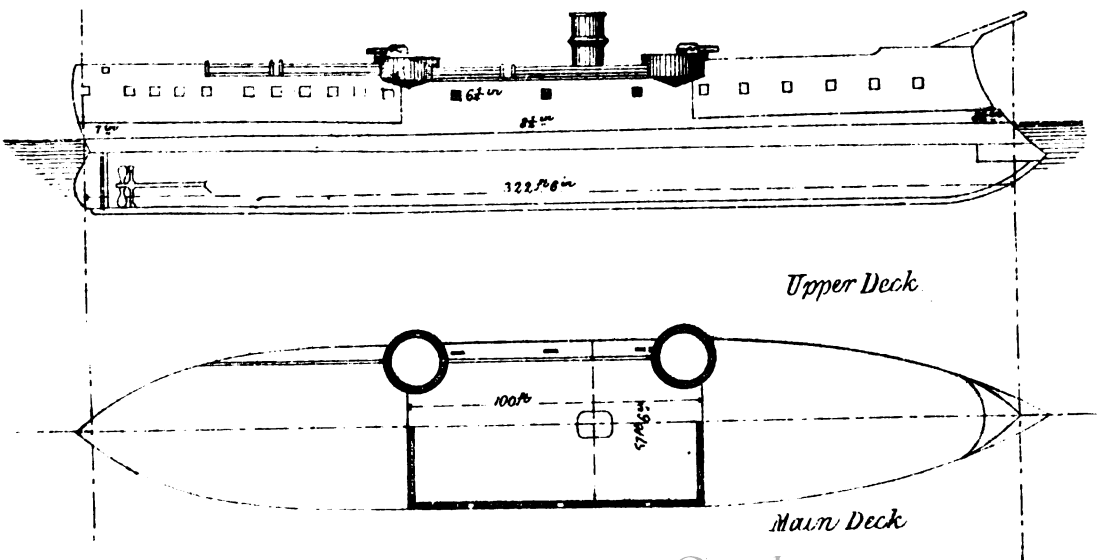


"Richelieu"



"Richelieu"

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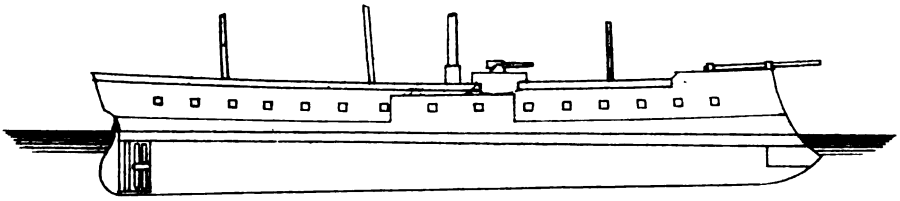
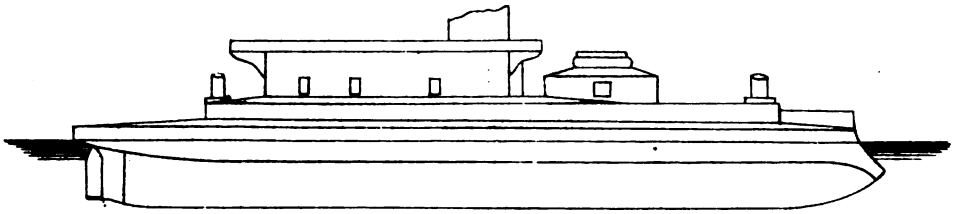
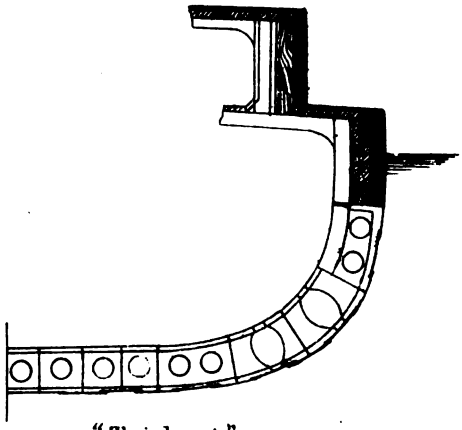
"Thétis."

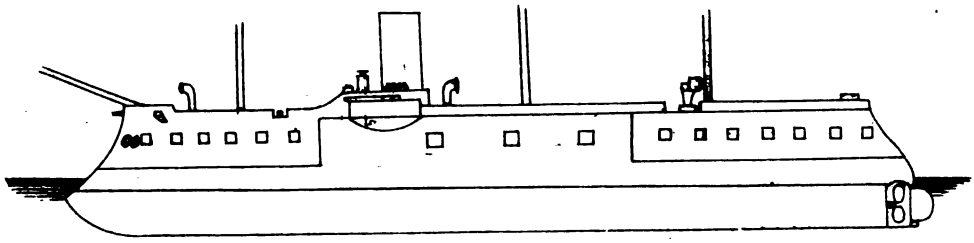


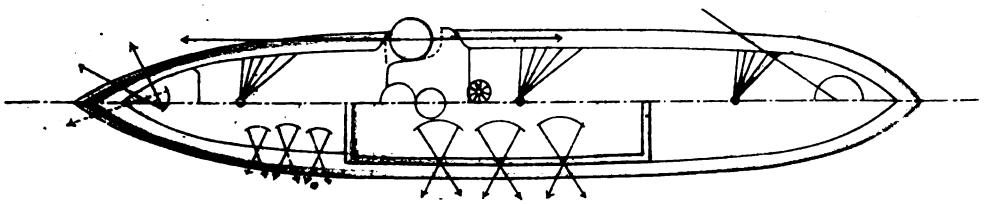
"Tonnerre."





"Trident."





MARIANT LITH

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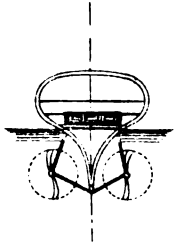
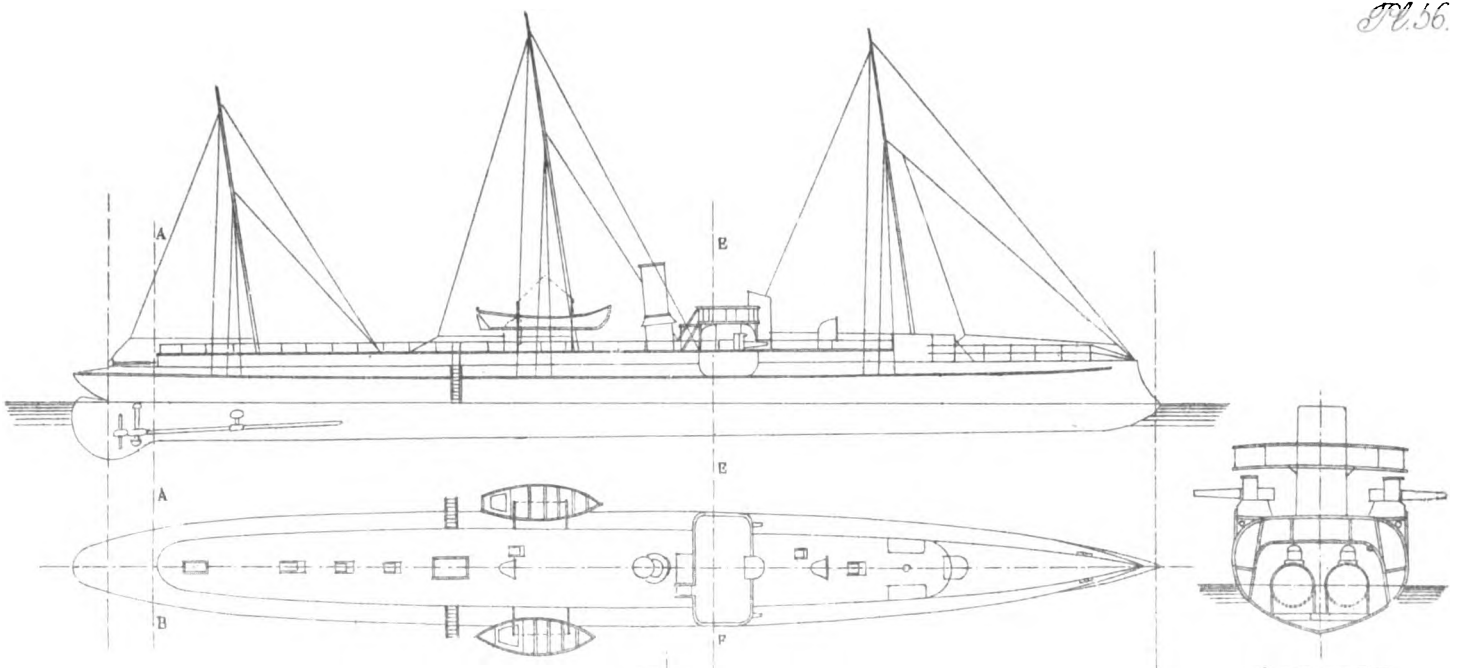
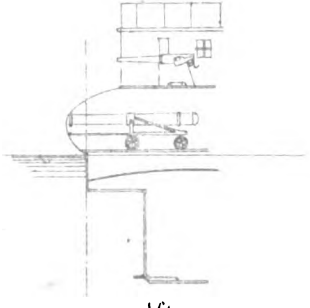


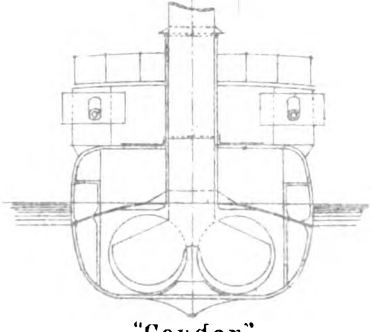
Section on A B



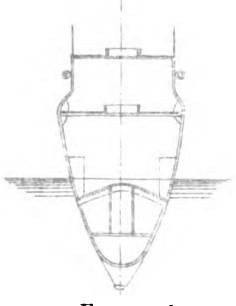
Section on E F.



Aft.



"Condor"
Before the Engine Room.



Forward.

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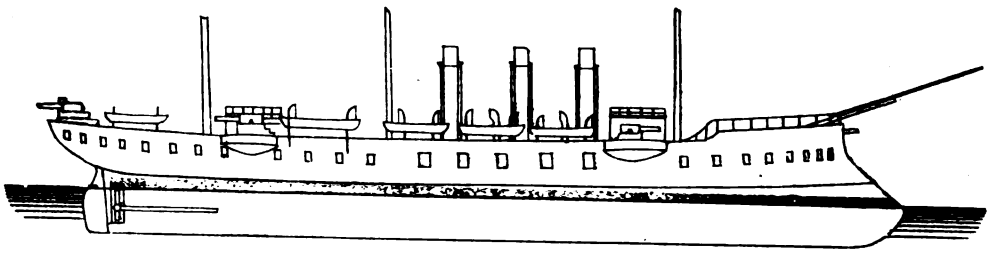
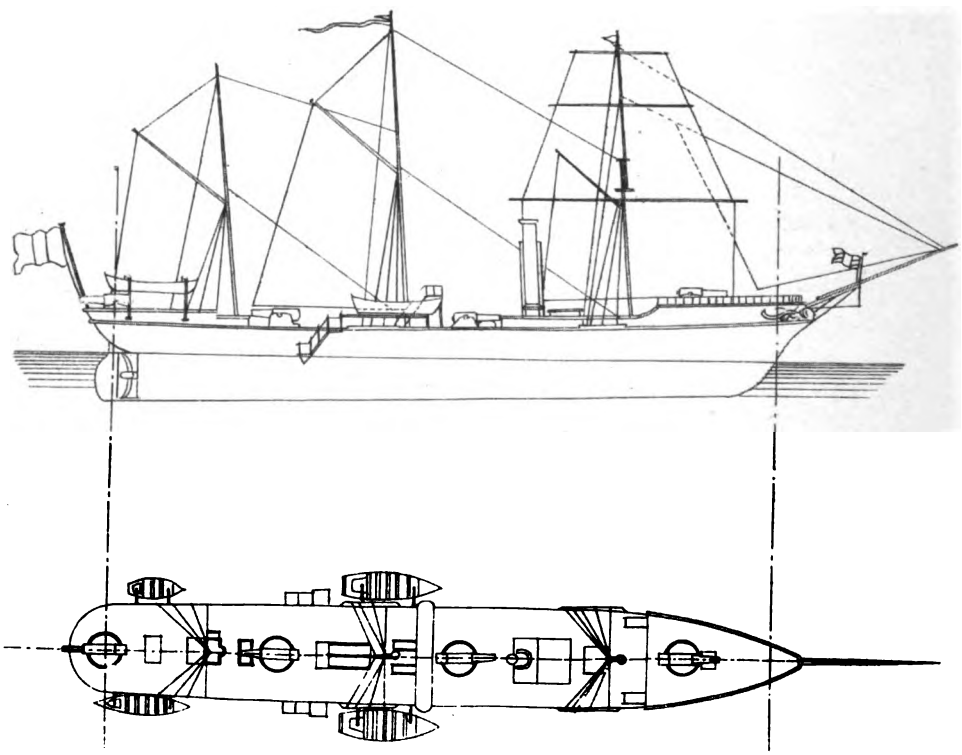
"Cécille".



"Comète".



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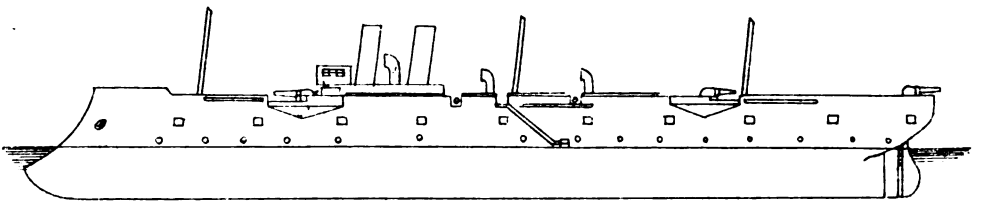
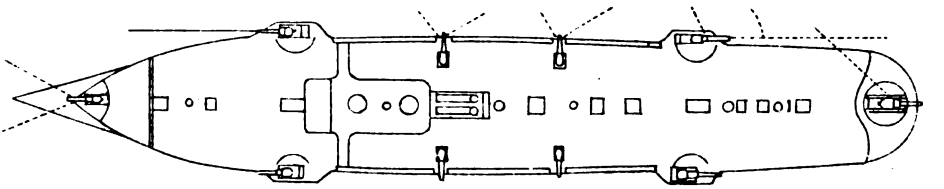
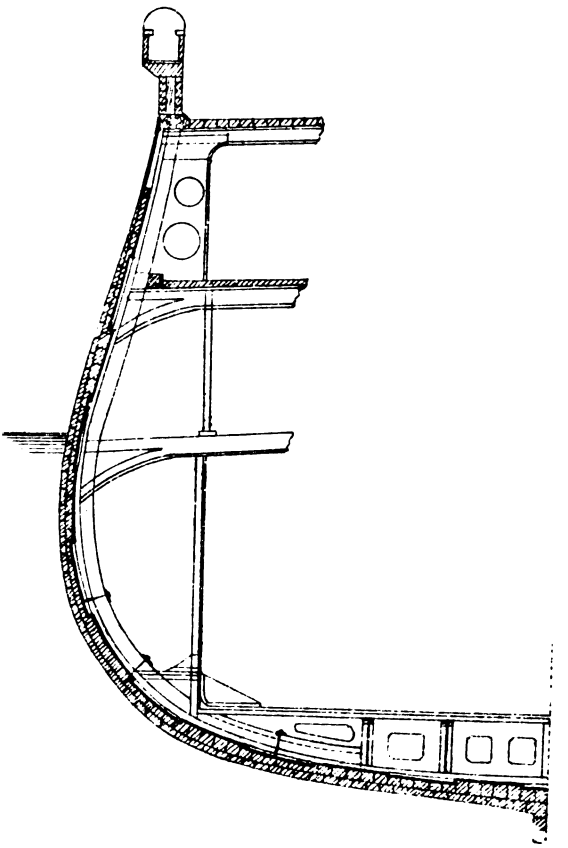
"Duguay- Trouin."



Upper Deck.





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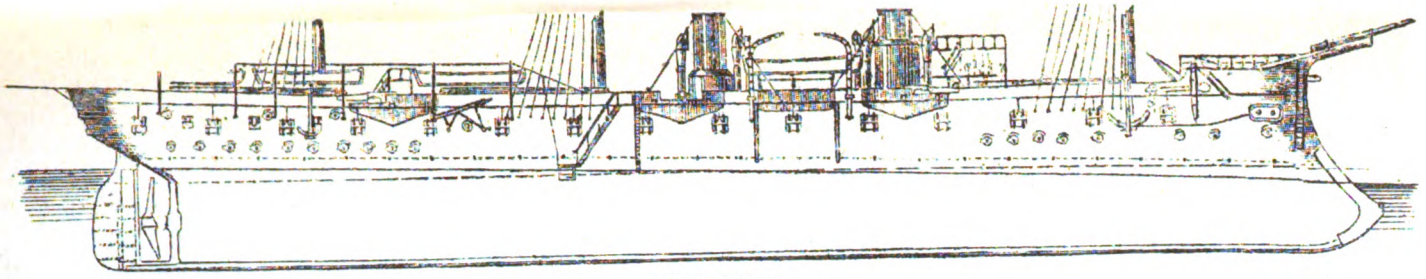
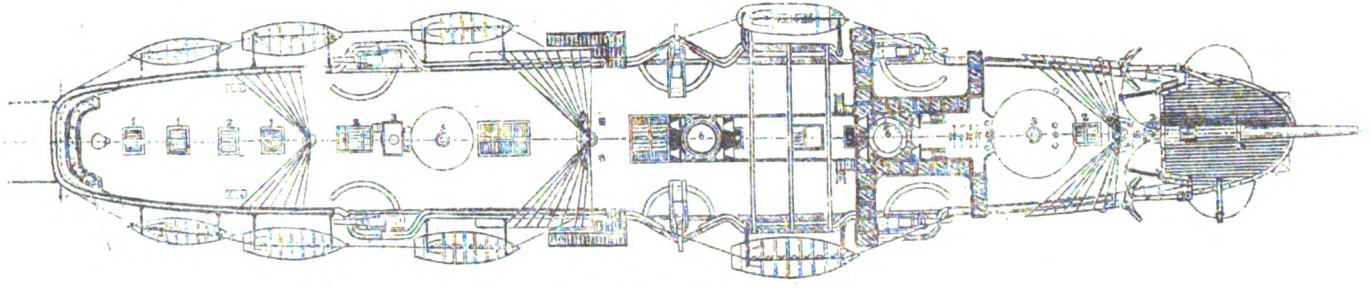
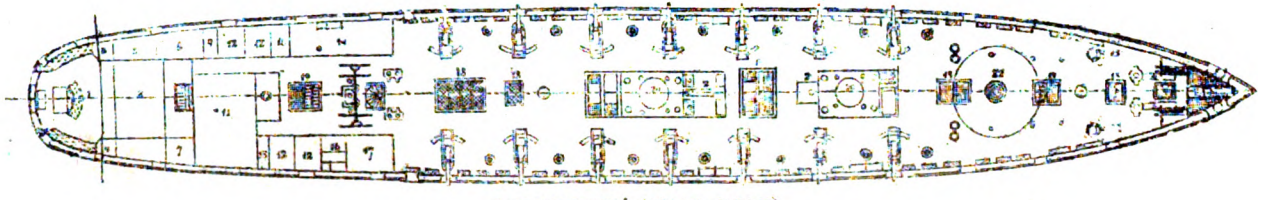


'DUQUESNE.



'DUQUESNE' (UPPER DECK).



'DUQUESNE' (MAIN DECK).

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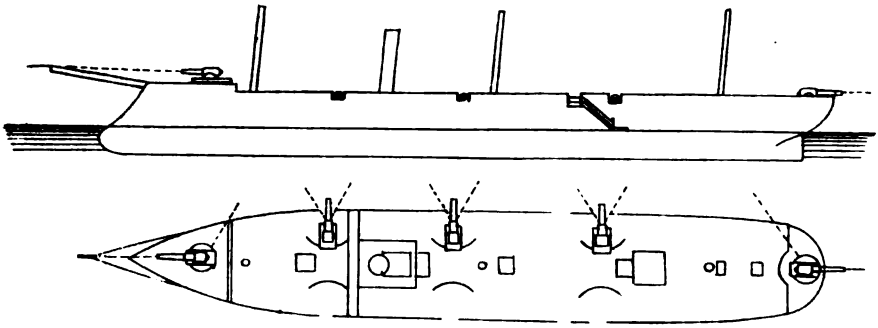
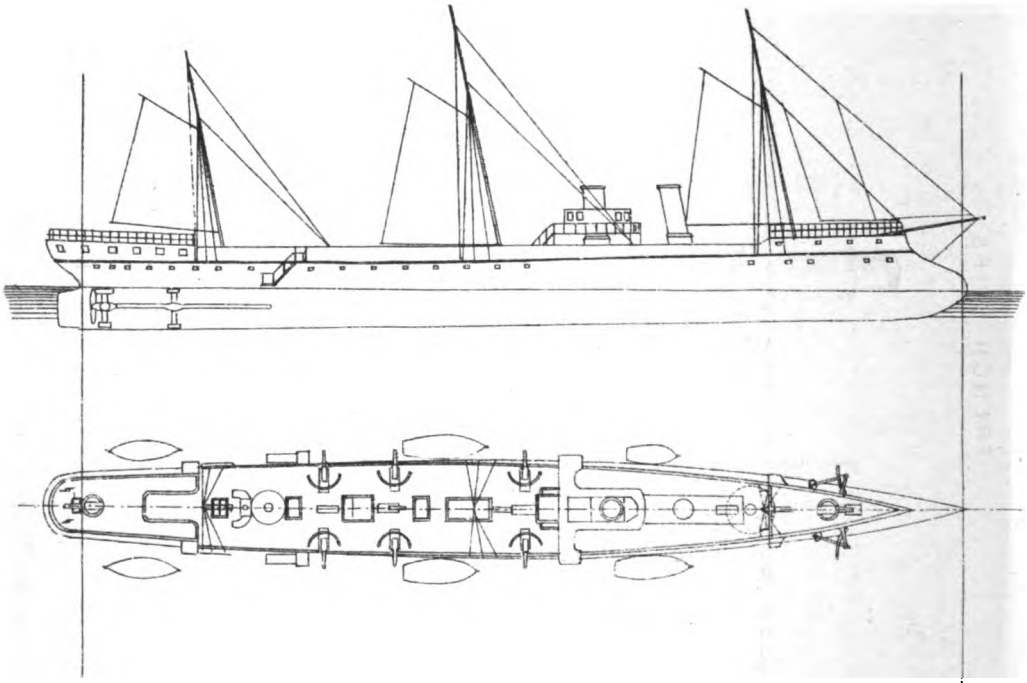
FRENCH SHIPS.

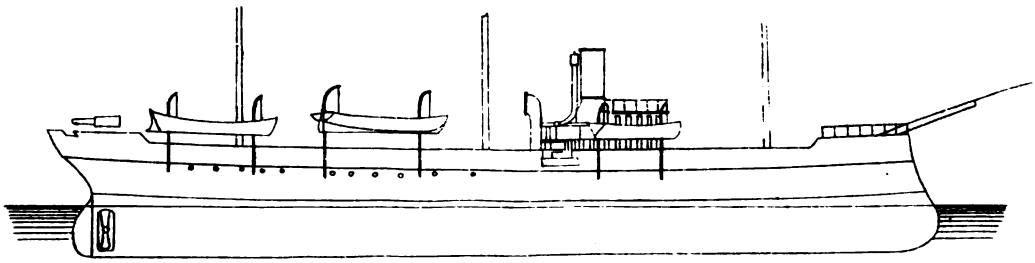
"Eclaireur."



"Milan."



"Roland."



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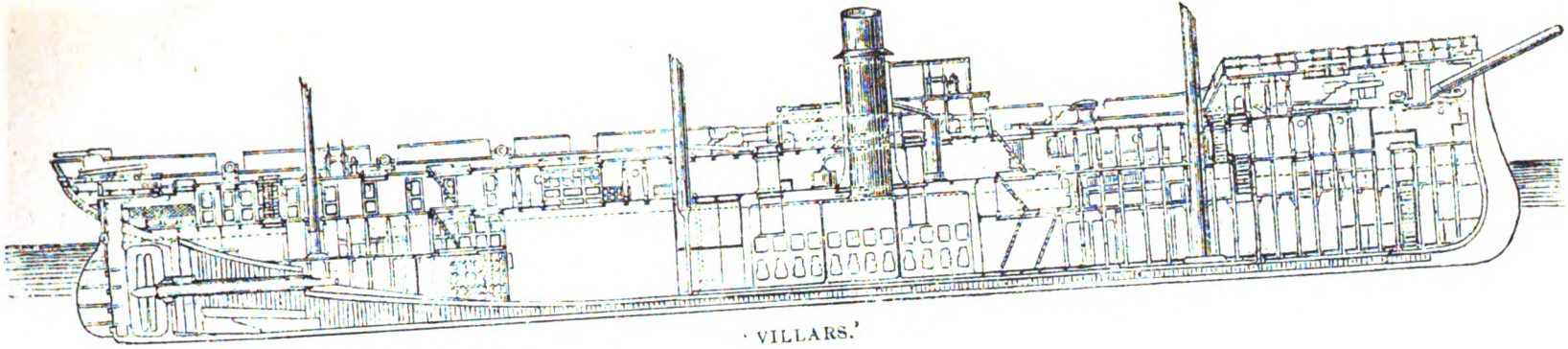
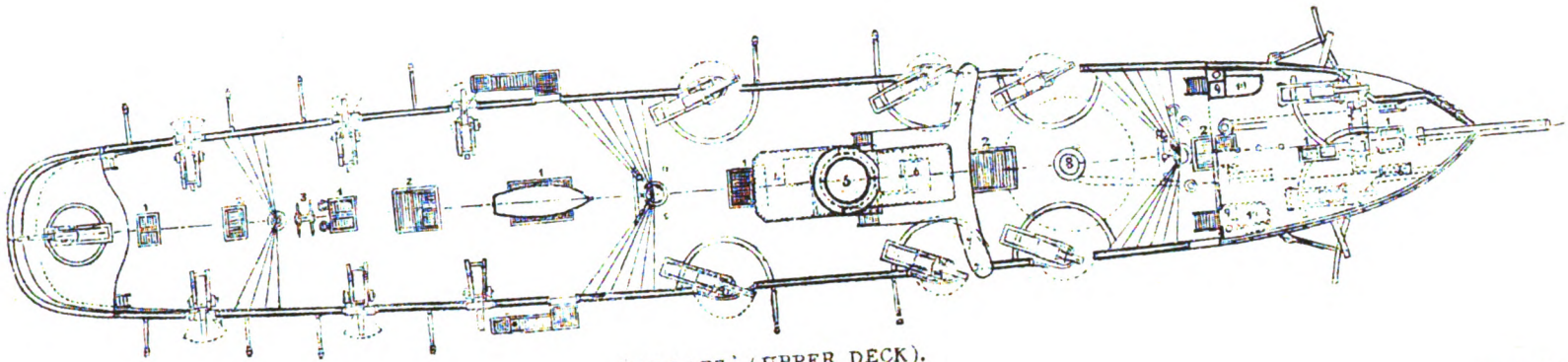
FRENCH SHIPS.



'VILLARS.'



'VILLARS' (UPPER DECK).

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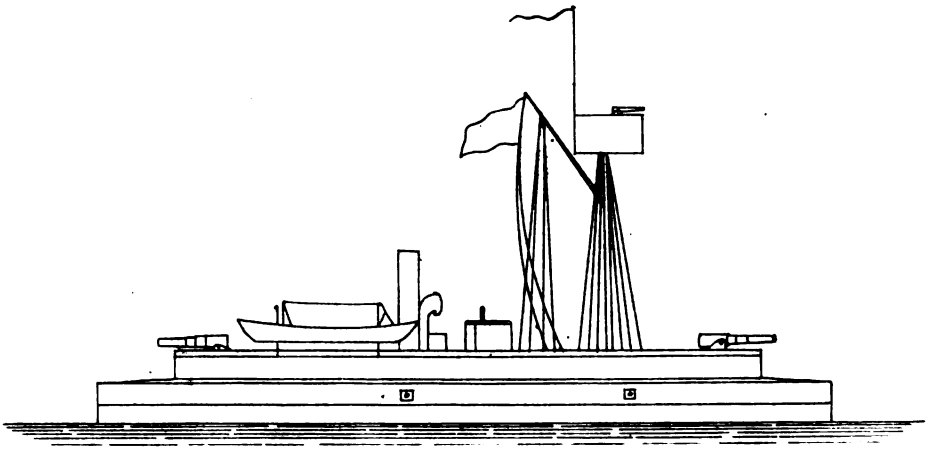
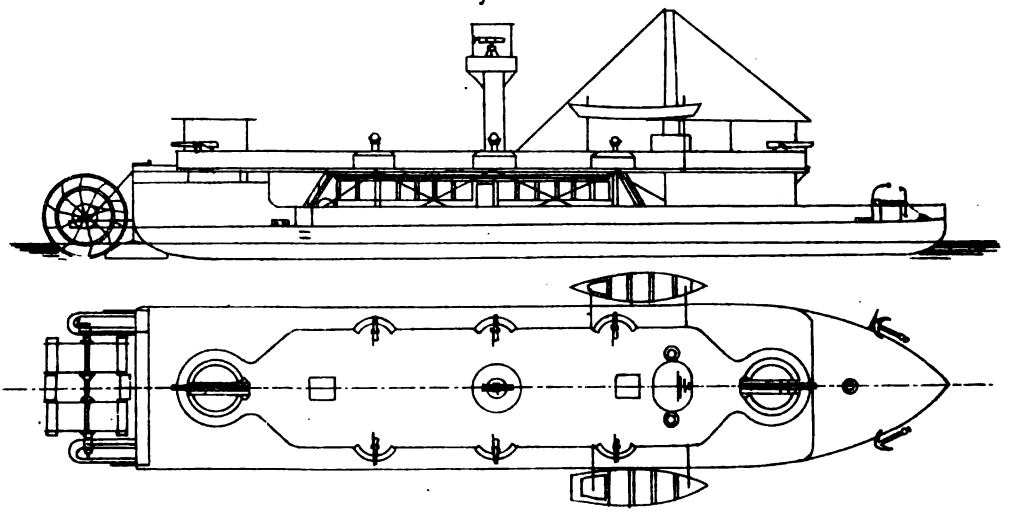
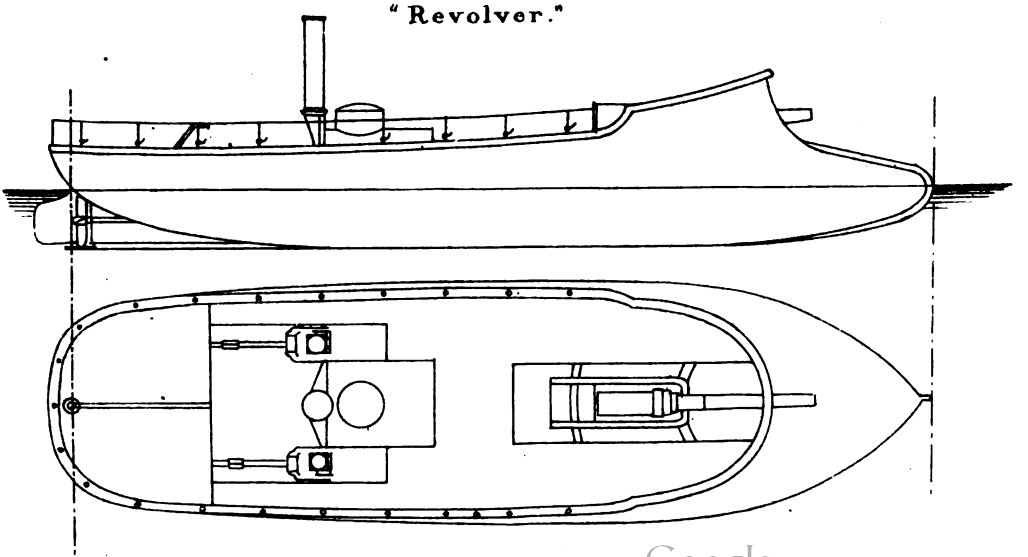
"Arquebuse."



"Henry Rivière."



"Revolver."



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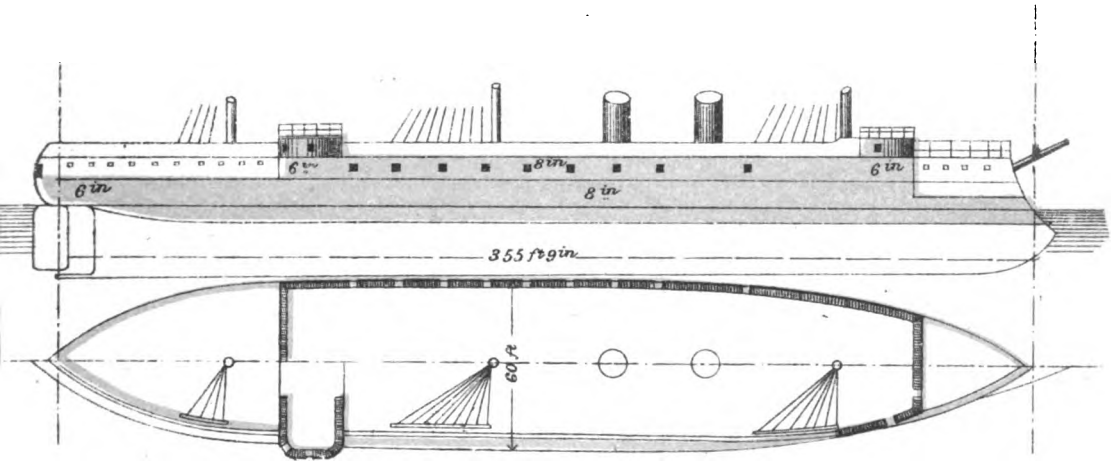
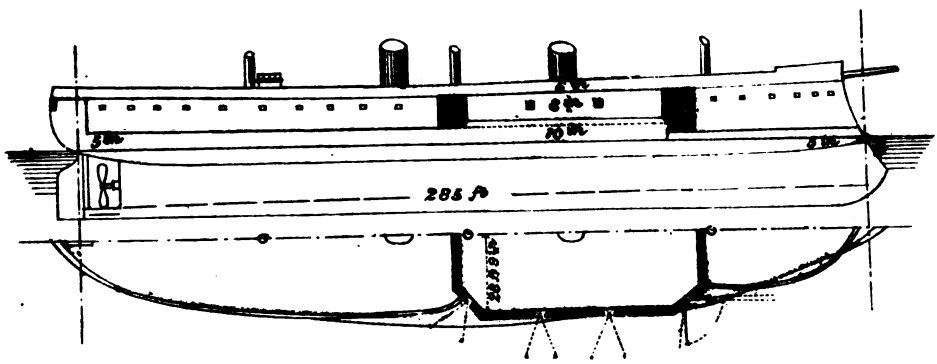
König Wilhelm.



"Kaiser" *Class.*



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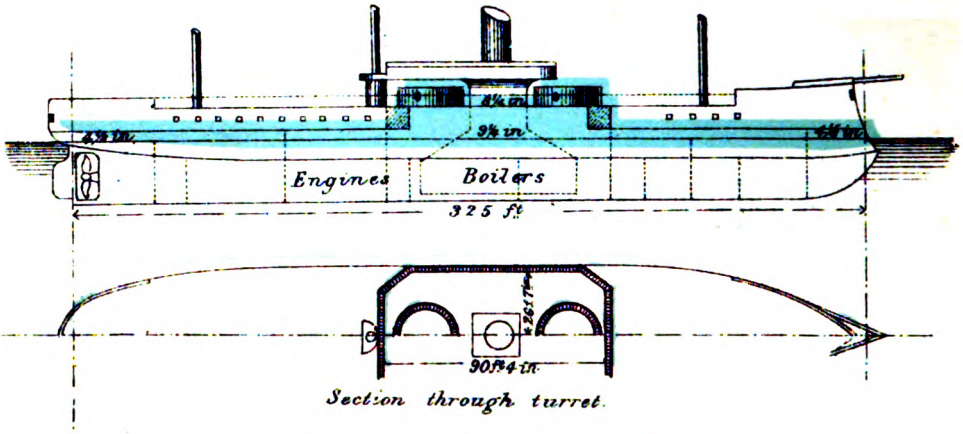
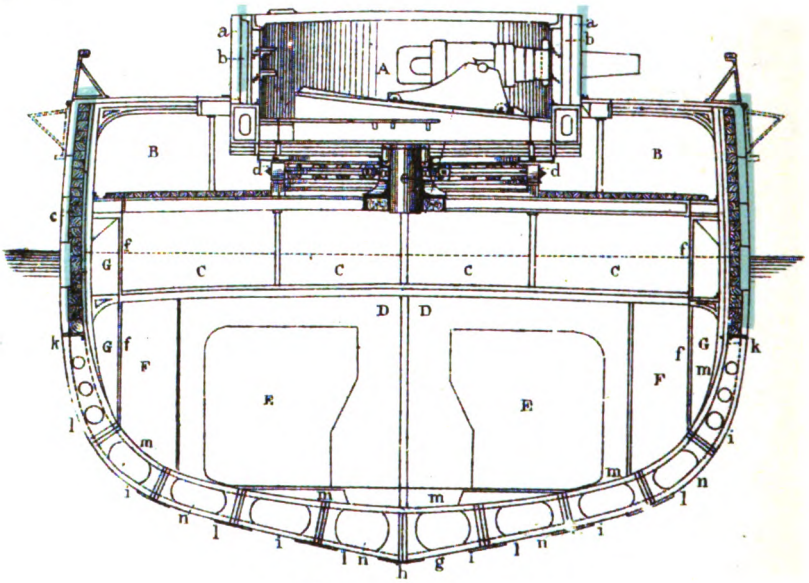
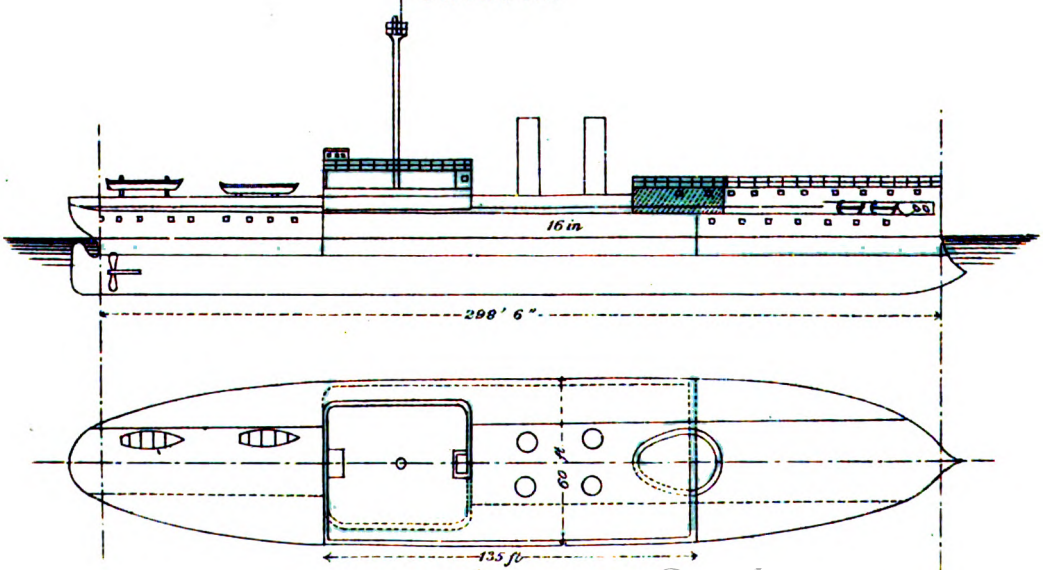


Section through turret.



"Sachsen"



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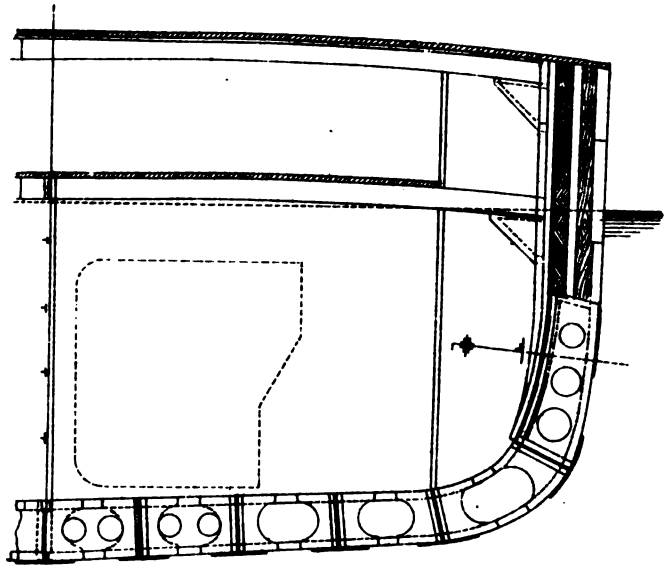
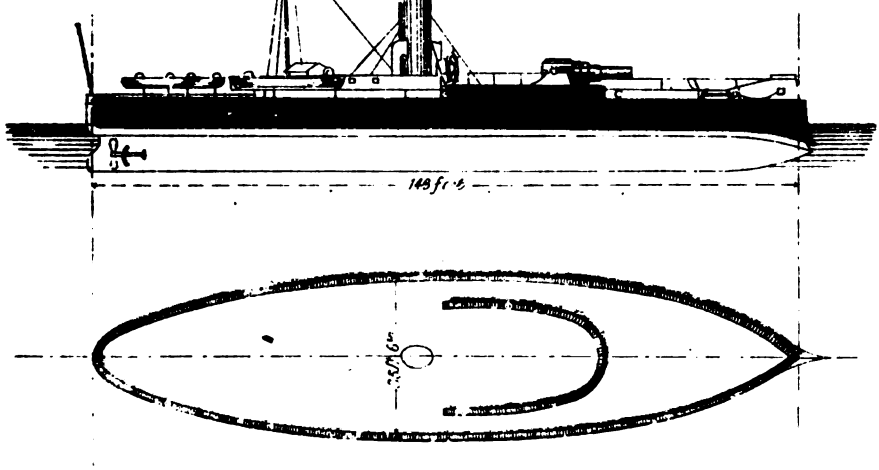
GERMAN SHIPS.

Half Midship Section "Sachsen".



Armoured Gun Boat

"Wespe" Class.



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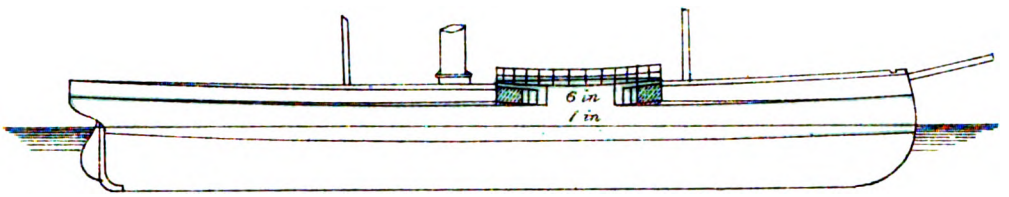
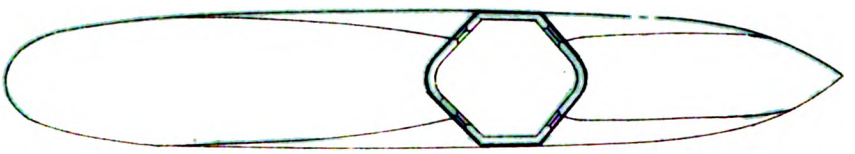
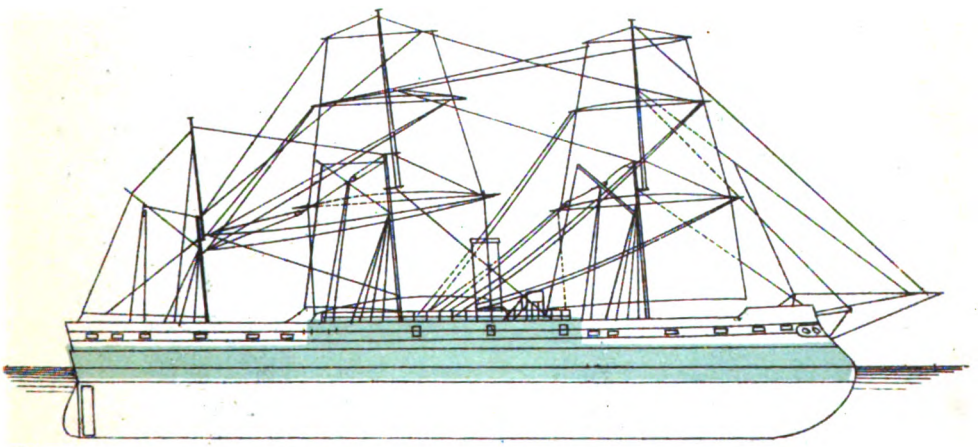
GREEK SHIPS.

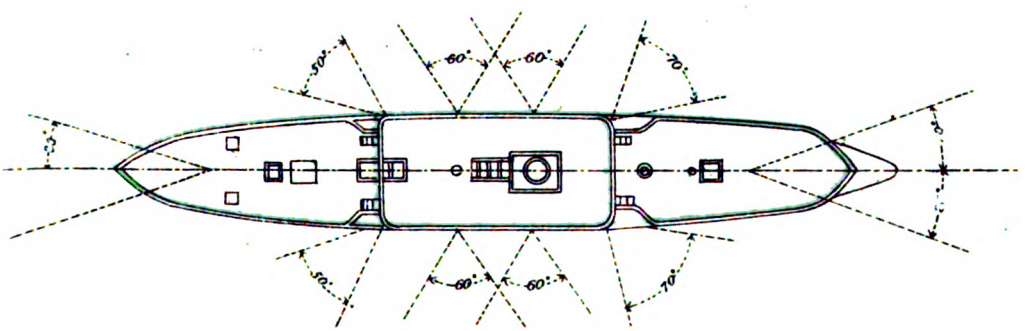
"King George."





"Olga."





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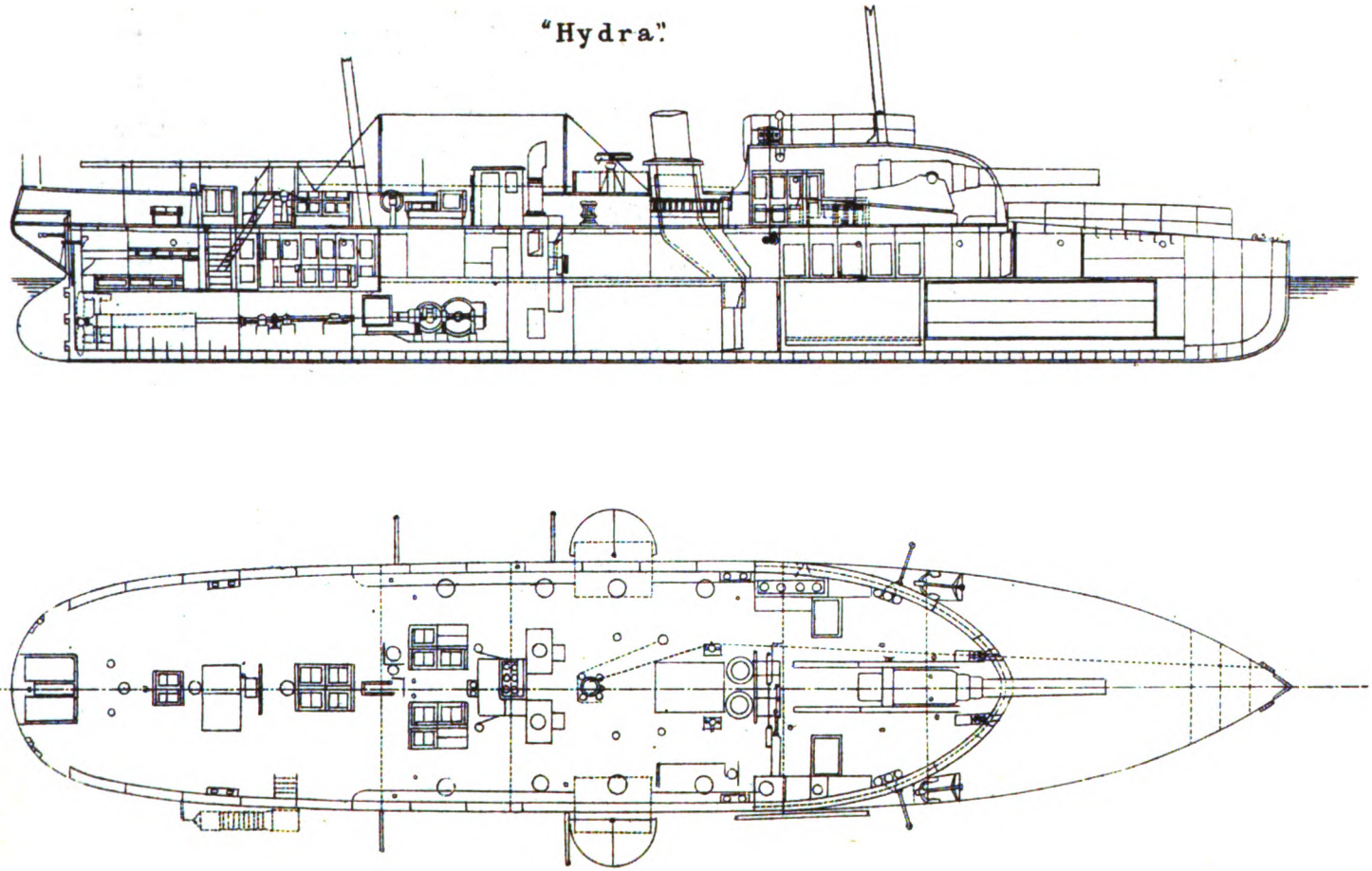
GREEK SHIPS.

"Hydra."



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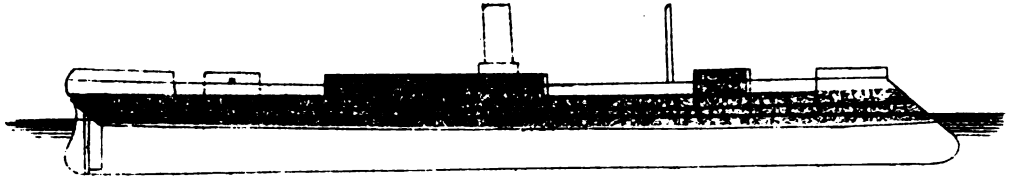
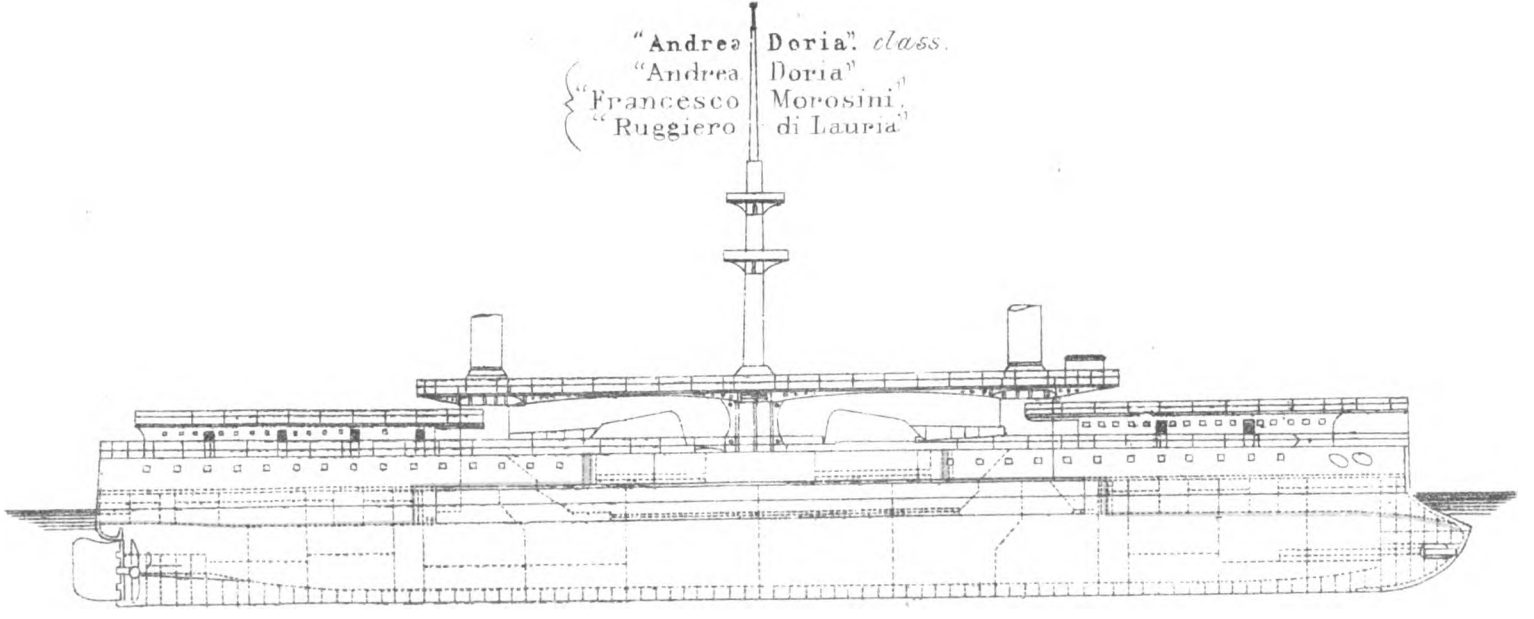
"Affondatore."



"Andrea Doria" class.

"Andrea Doria"
"Francesco Morosini"
"Ruggiero di Lauria"



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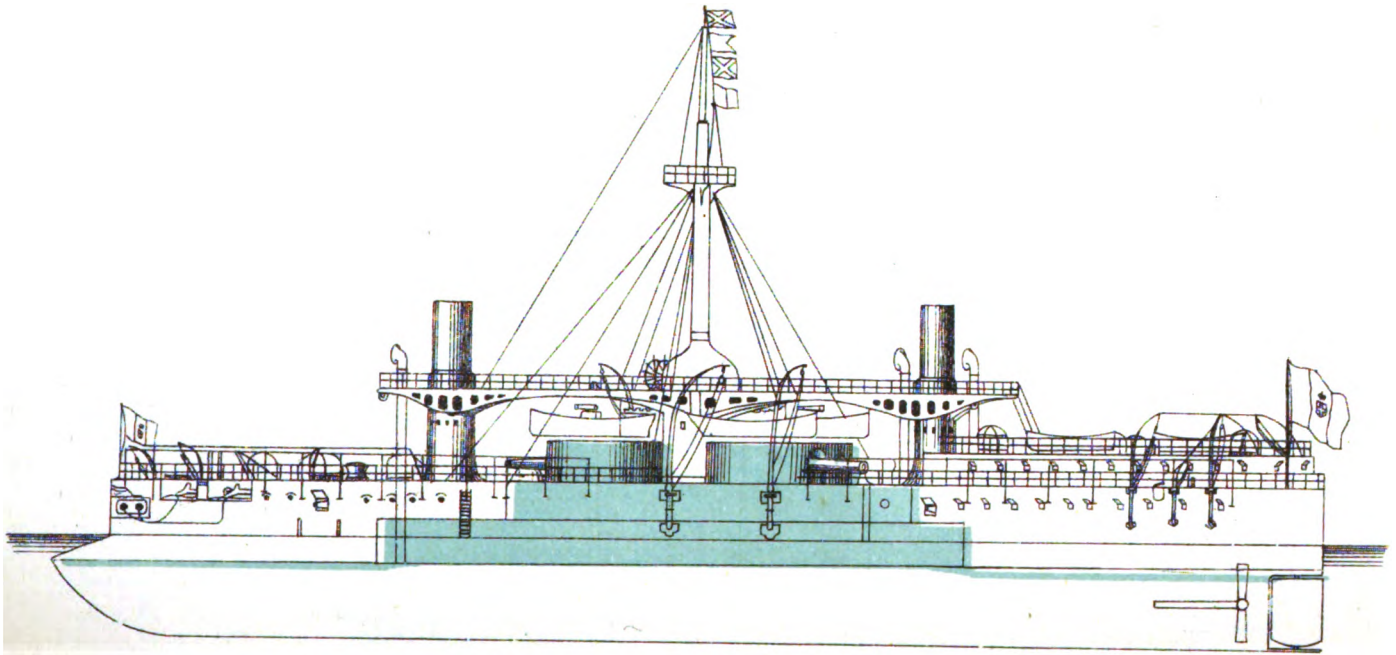
"Duilio."
"Dandolo".



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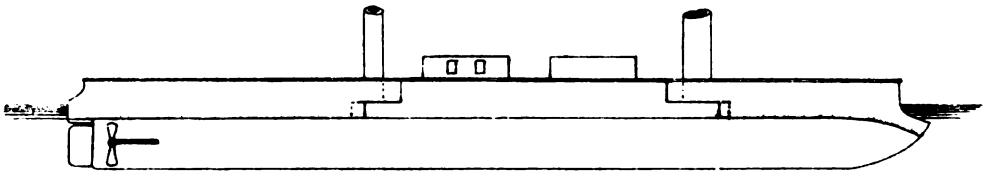
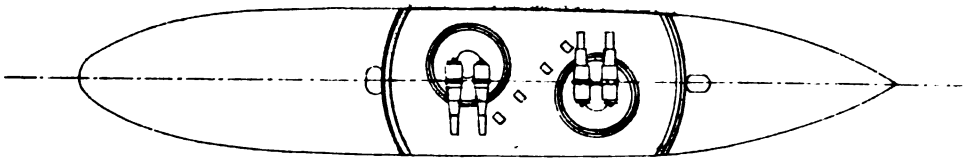
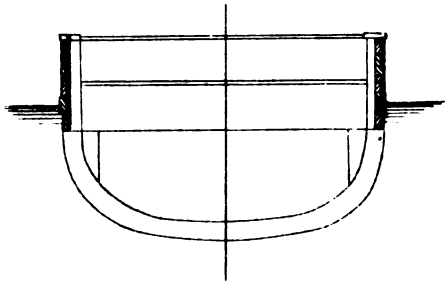
ITALIAN SHIPS.

"Duilio" & "Dandolo."







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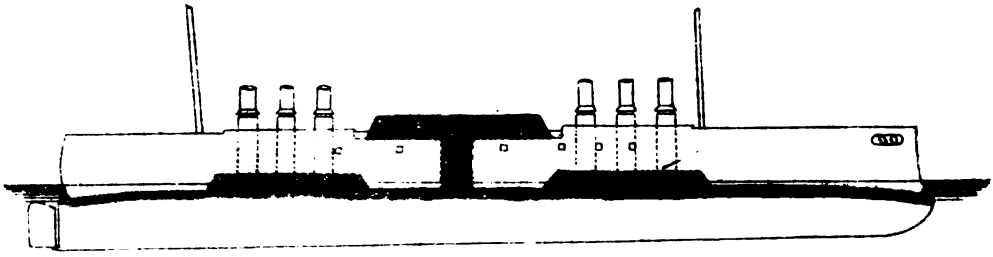
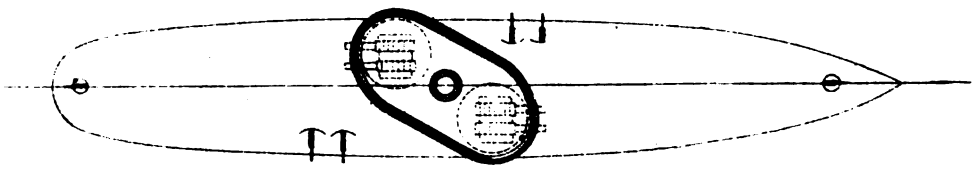
ITALIAN SHIPS.

"Italia" and "Lepanto."



Upper Deck.



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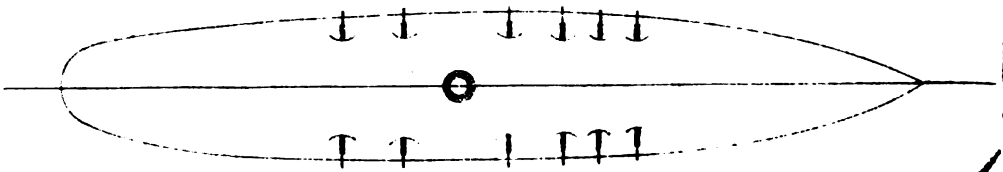
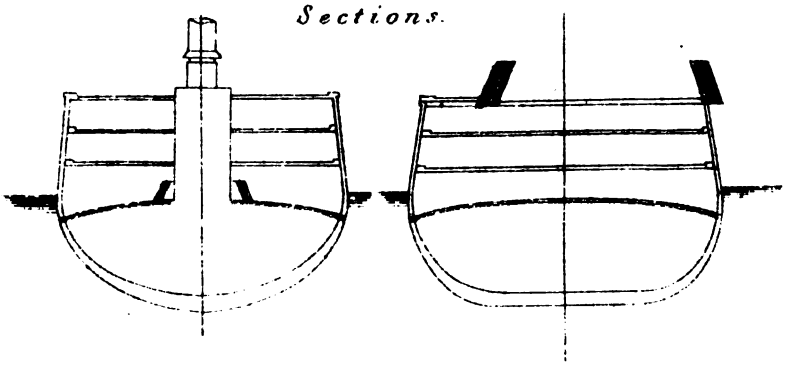


Sections.



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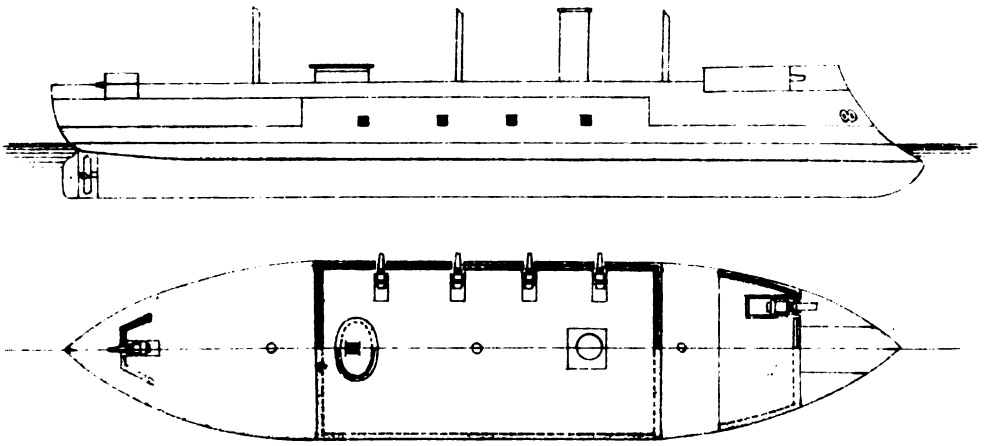
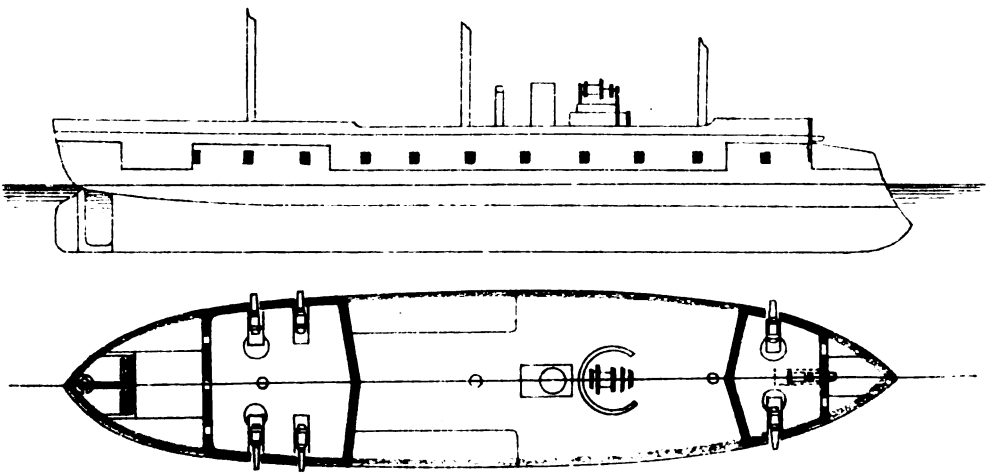
ITALIAN SHIPS.

"Maria Pia."



"Palestro."



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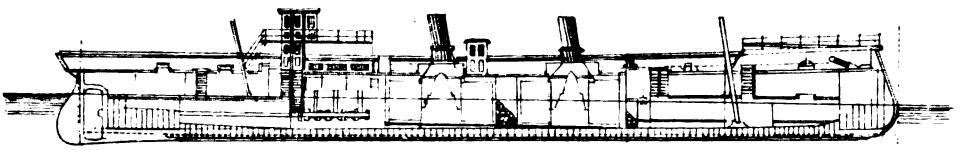
ITALIAN SHIPS.

Agostino Barbarigo.

Unarmoured Despatch Vessel.



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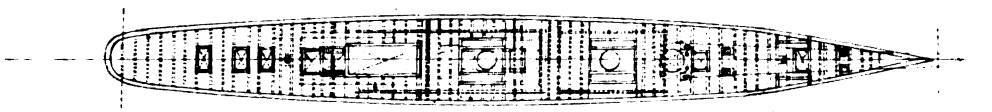

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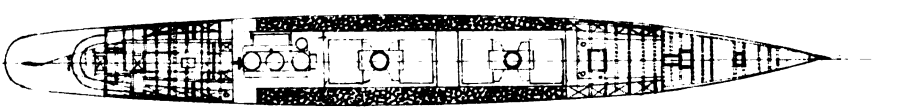

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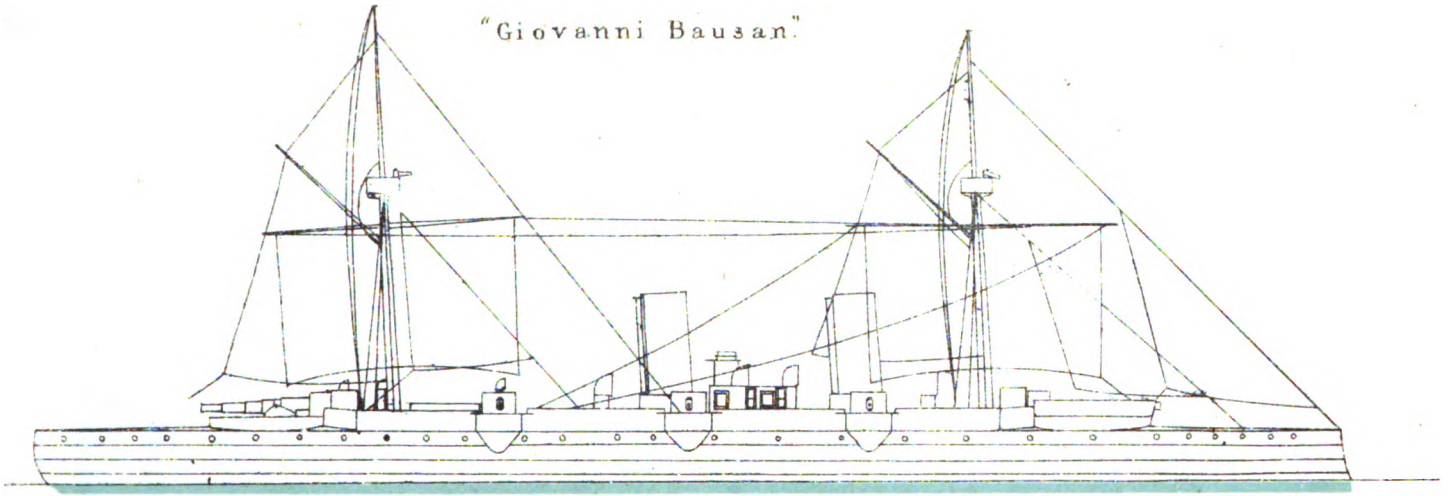
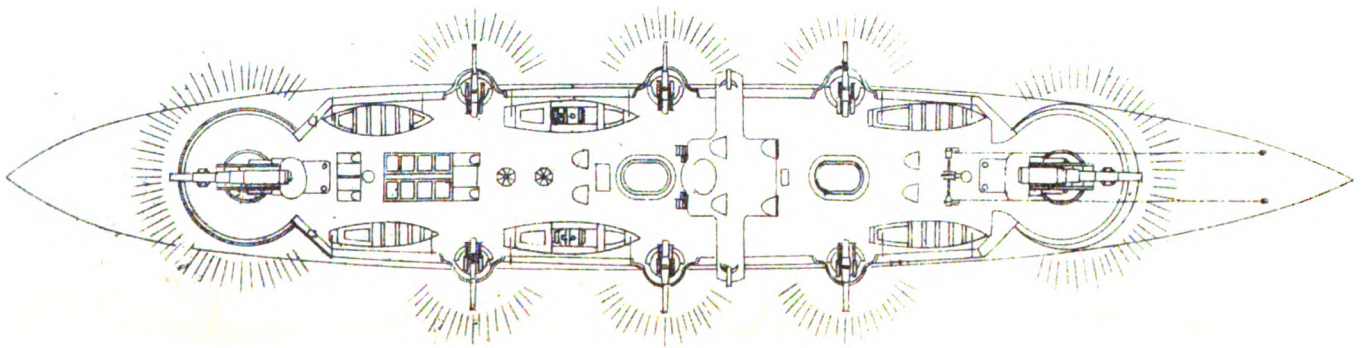
HANHART L. TH.

"Giovanni Bausan."





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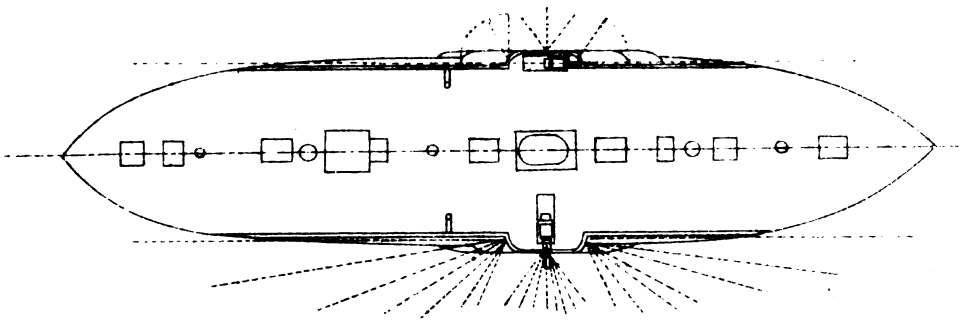
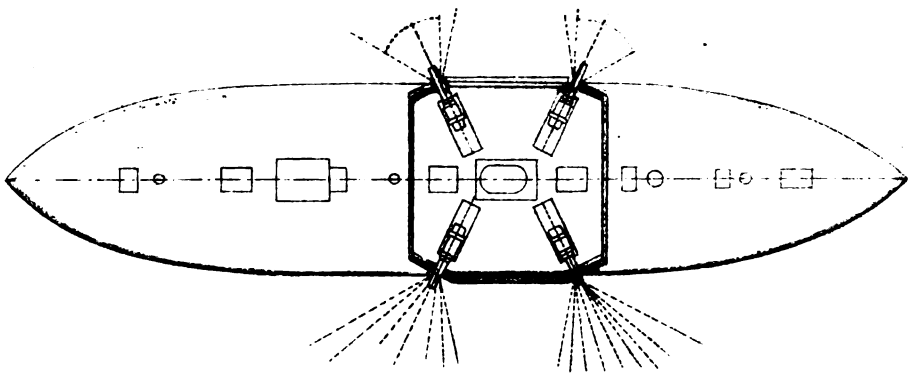
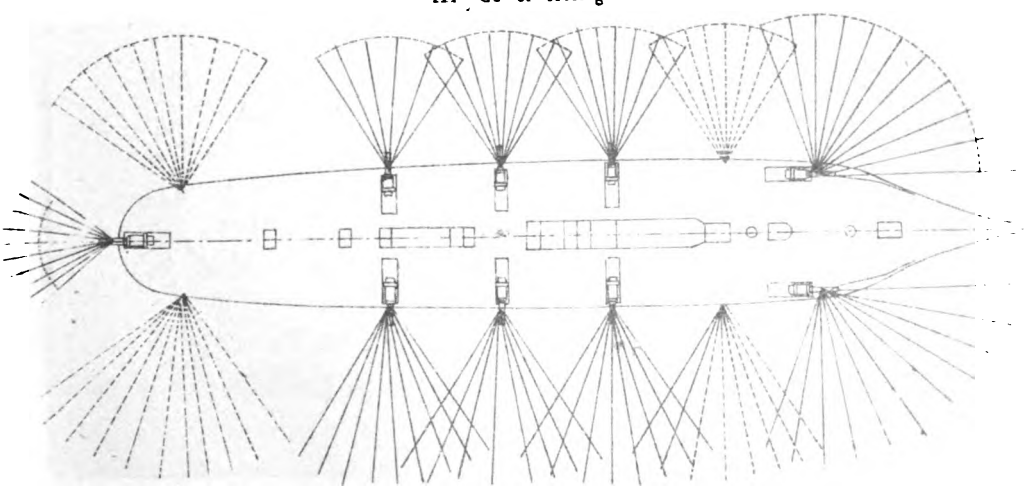
"Fu-Soo"





"Hi-yei" & "Kin-go"



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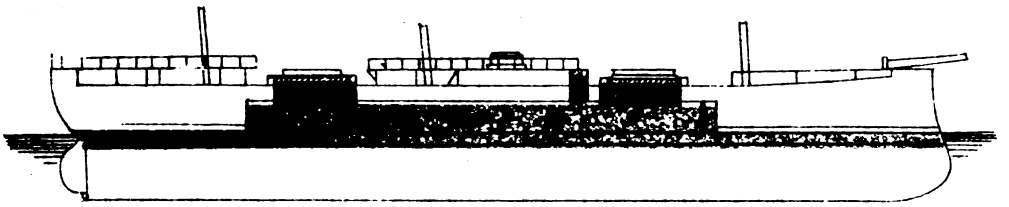
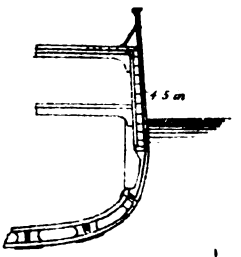
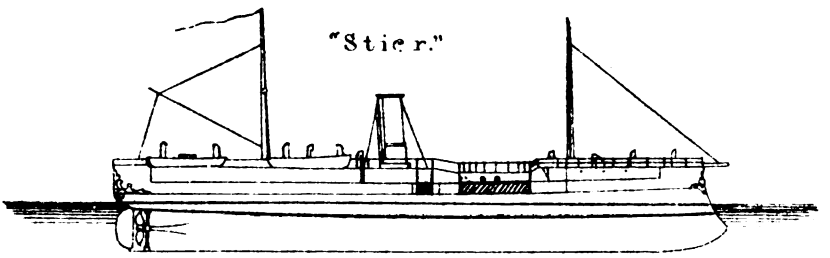
"Prinz Hendrik."



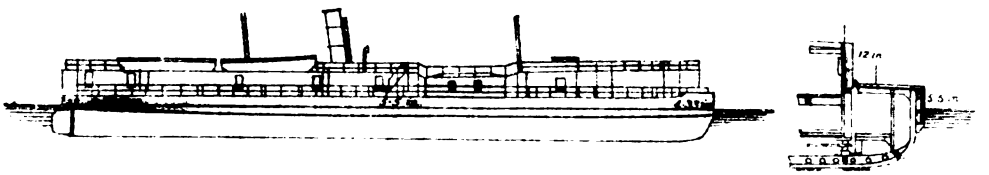


"Schorpionen."

"Stier."



"Tijger."



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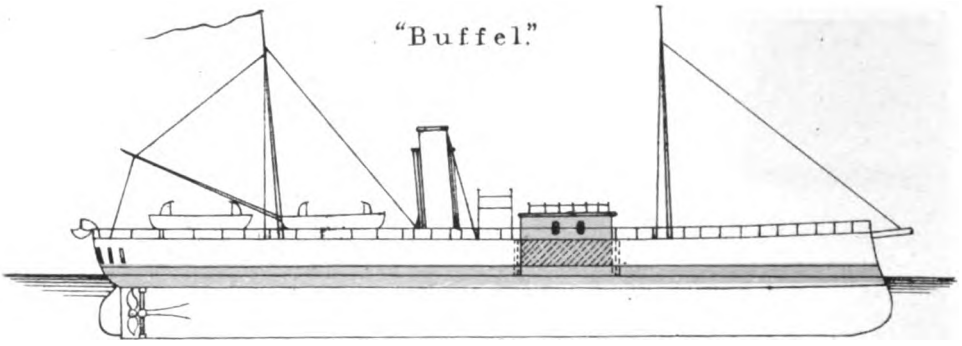
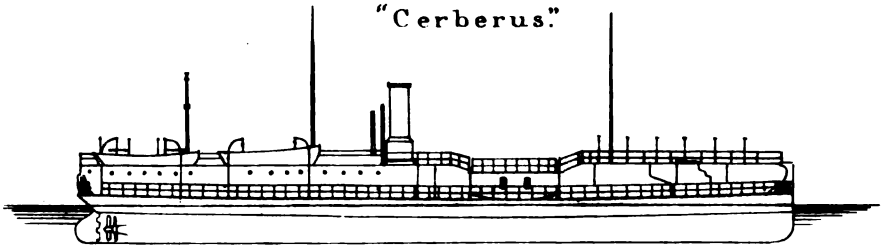
NETHERLANDS GOVT SHIPS.

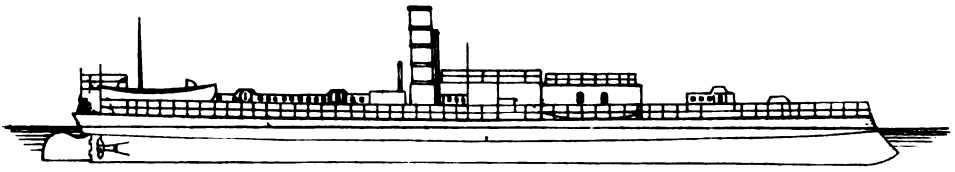
"Buffel."



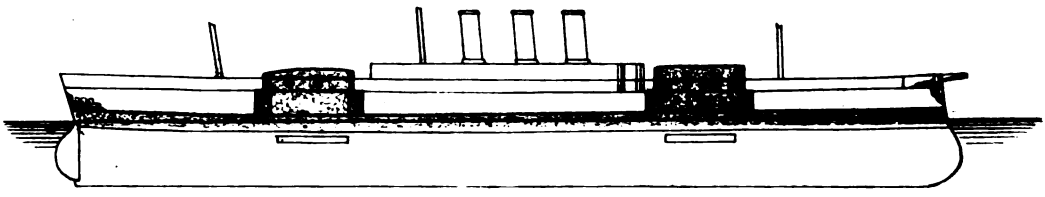
"Cerberus."

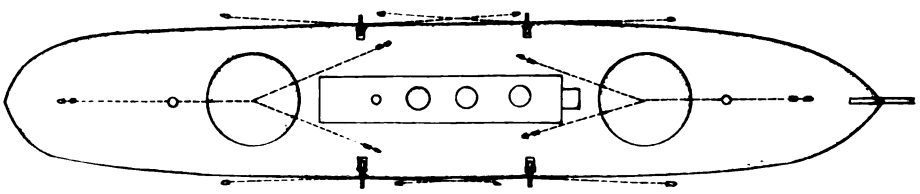


"Draak."



"Koning der Nederlander."





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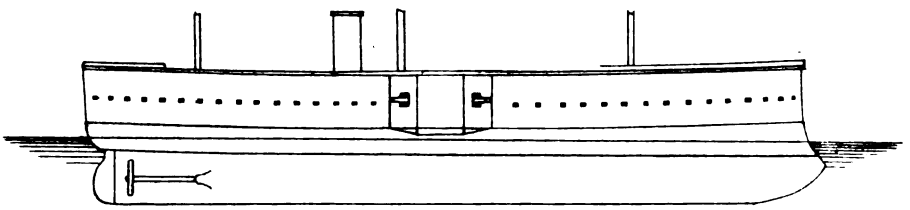
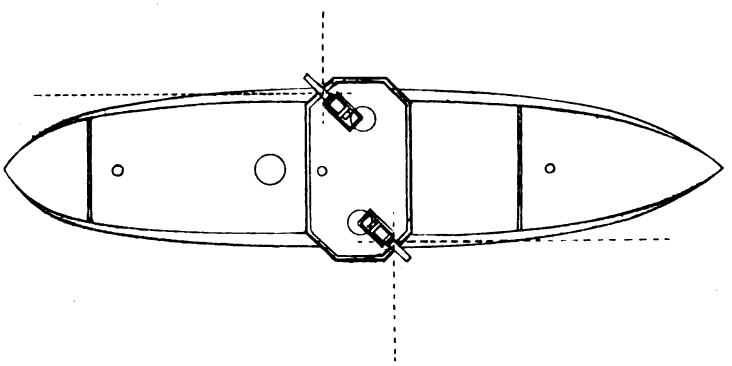
PORTUGUESE SHIPS.

"Vasco de Gama."





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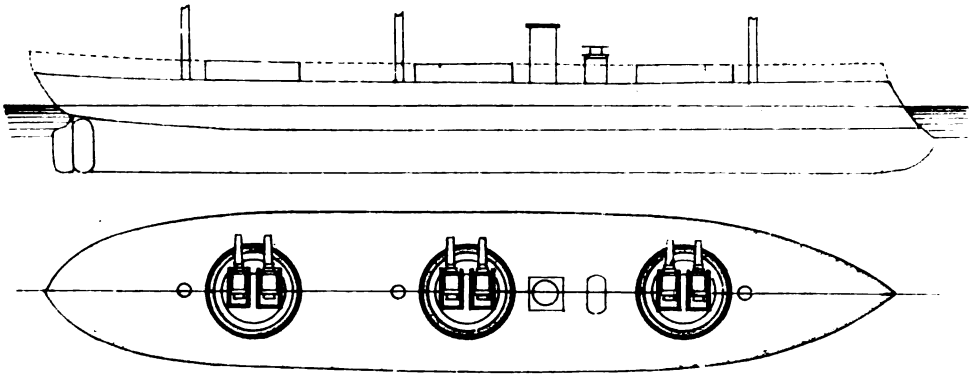
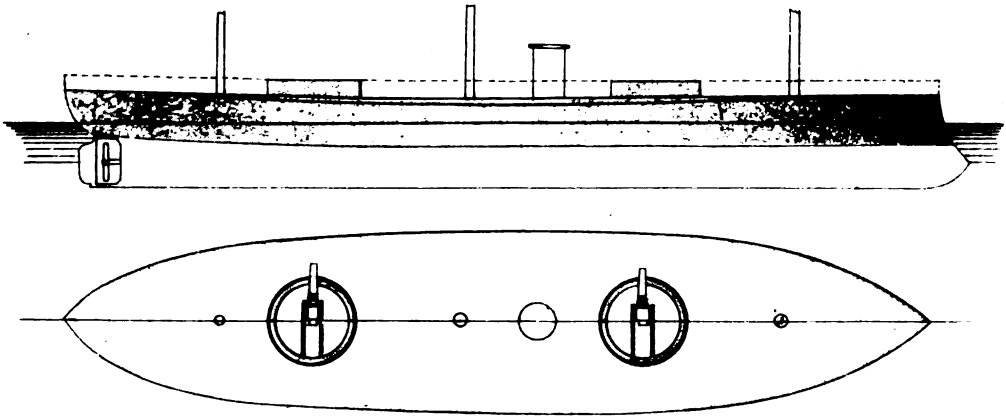
RUSSIAN SHIPS.

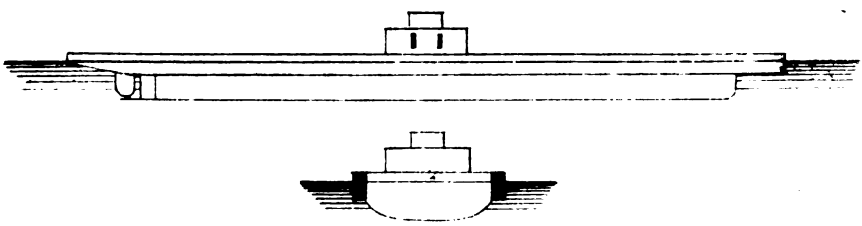
"Admiral Lazareff."



"Admiral Spiridoff."



"Bronenosetz."



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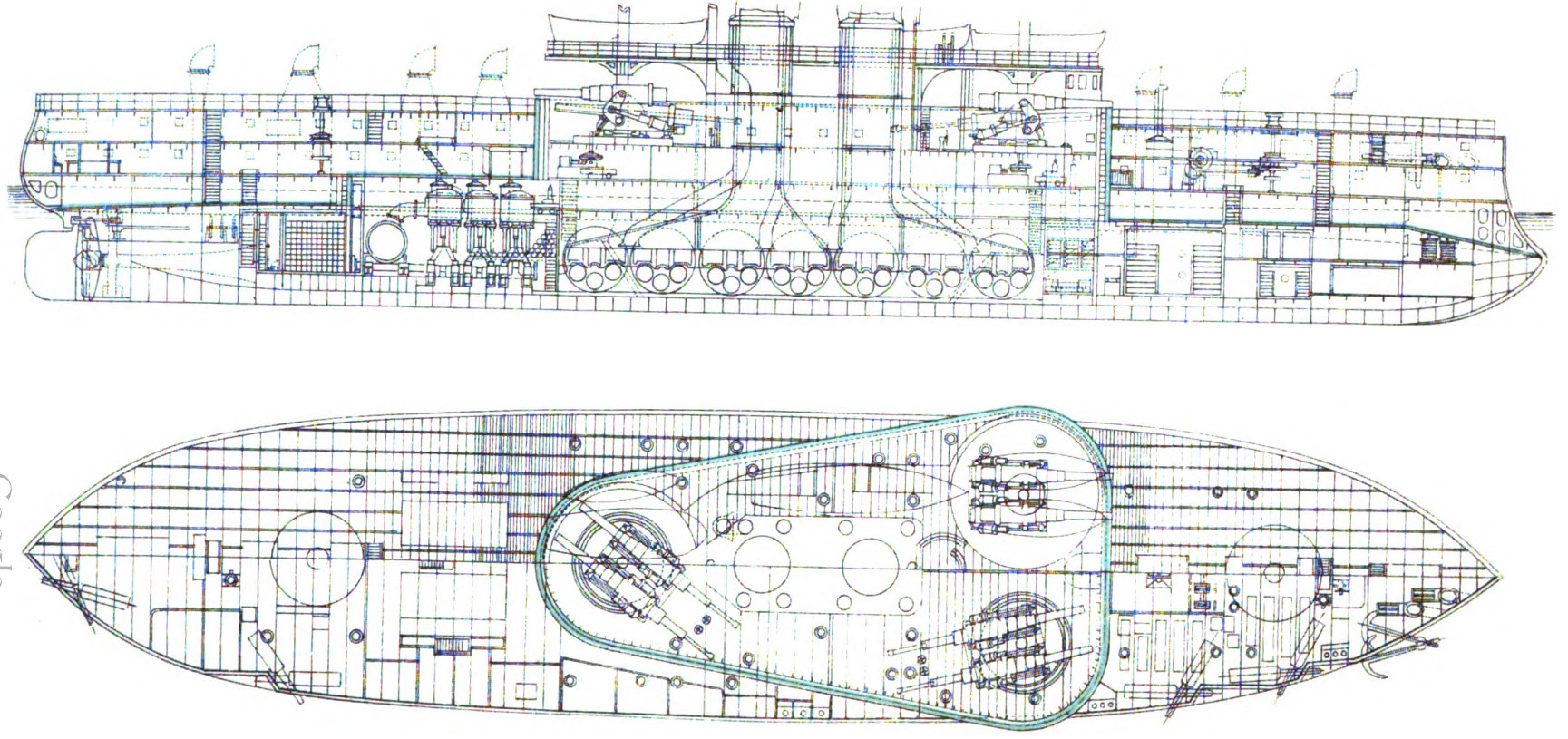

Catherine II.

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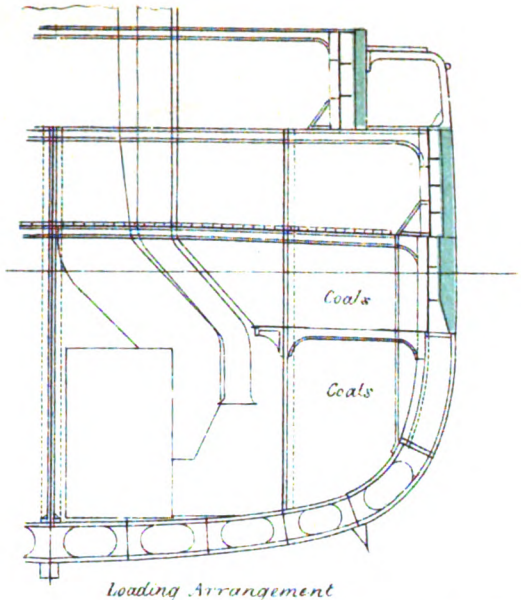
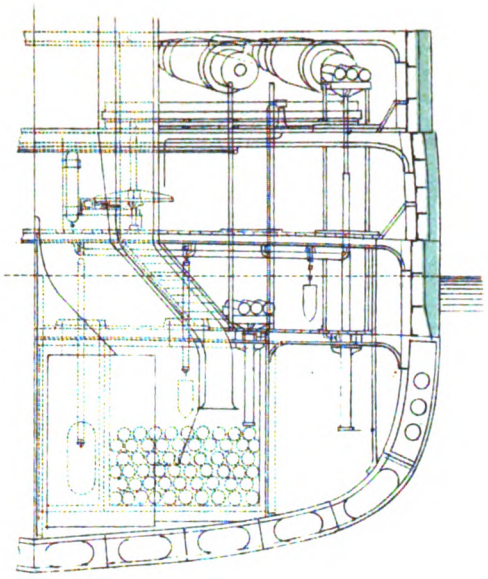
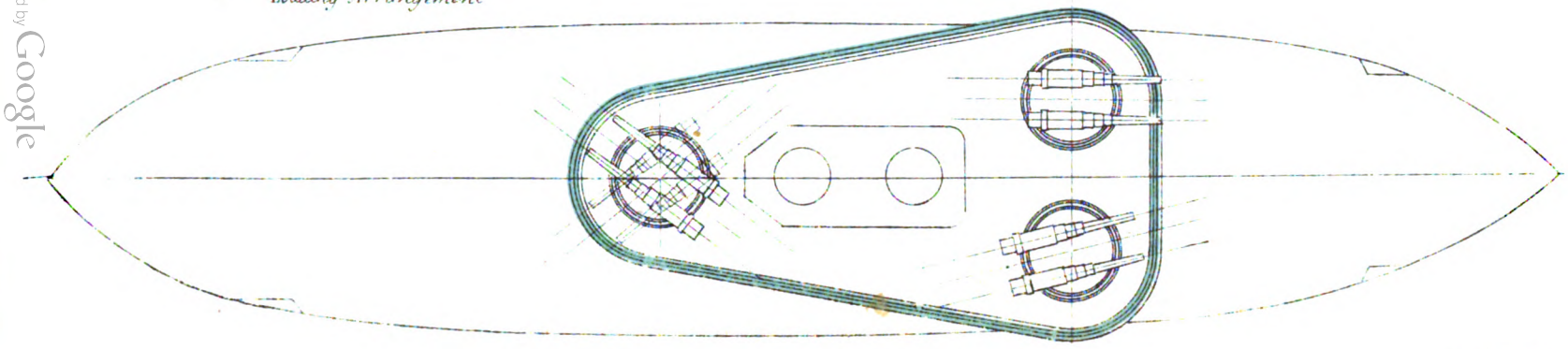
"Ichesme"
"Sinope"

RUSSIAN SHIPS.



Loading Arrangement





Catherine II.

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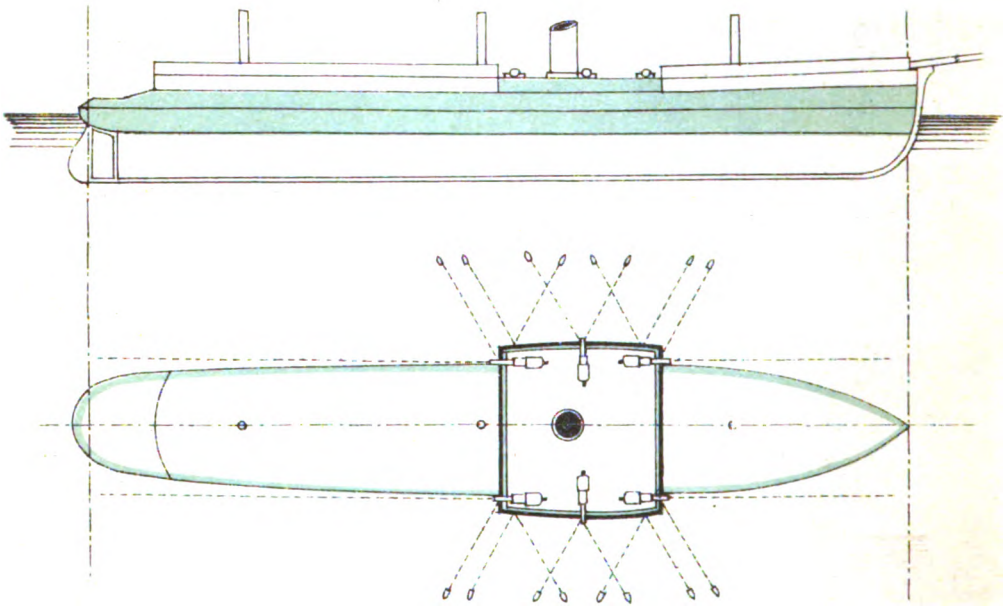
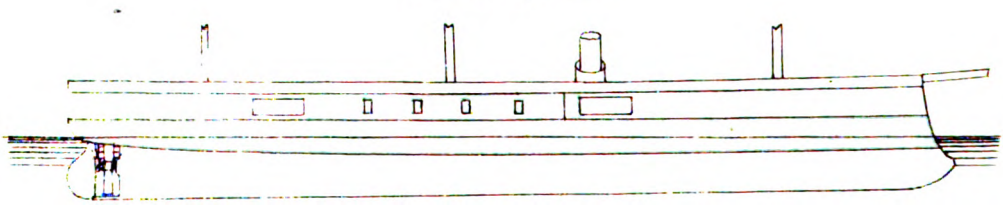
98.81.

RUSSIAN SHIPS.

"General-Admiral."



"Kniaz Pojarski."



"Lava, Tifun, Uragan," &c.

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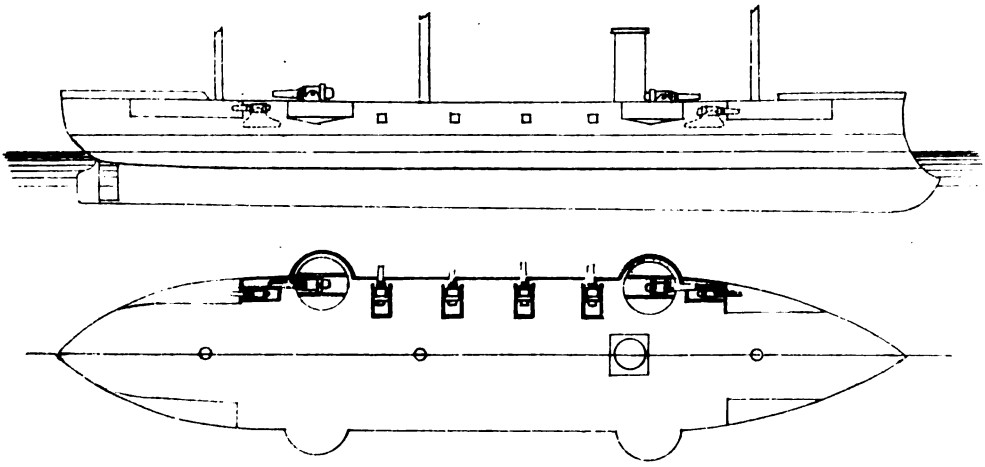
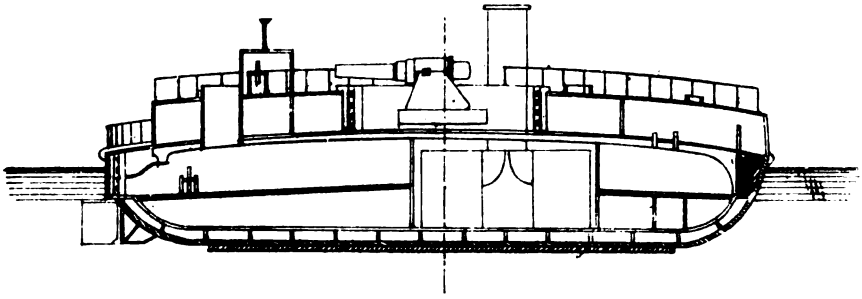
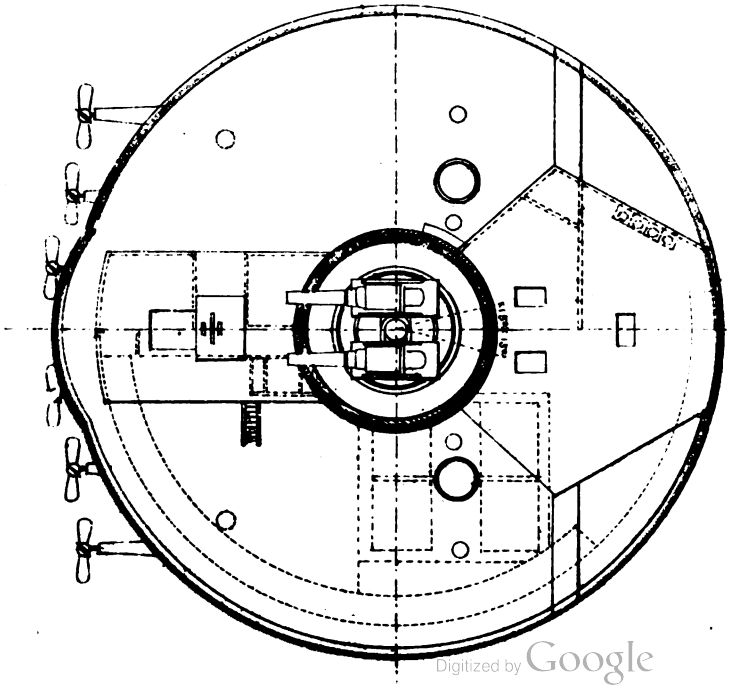
"Minin."



"Novgorod", *Section.*



Plan.



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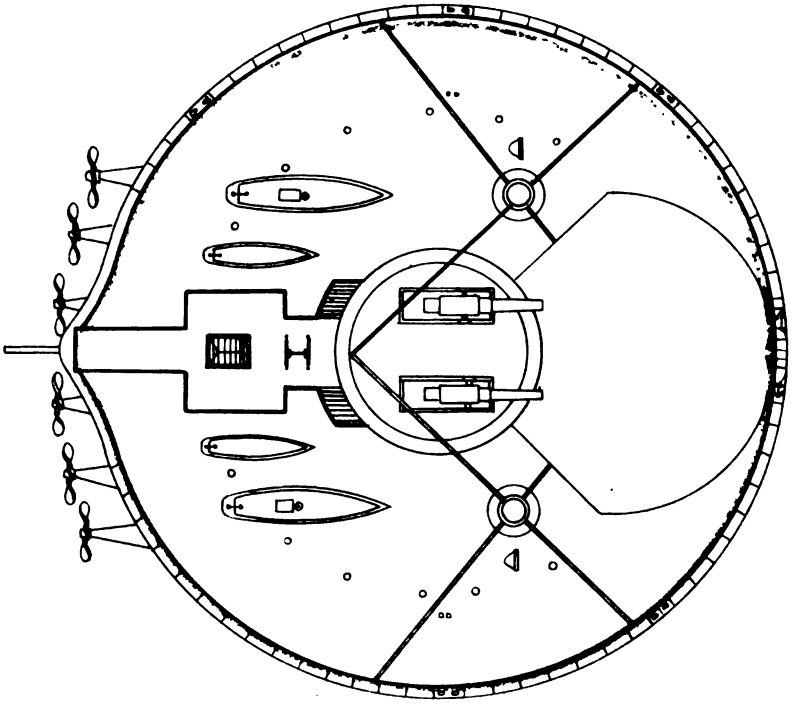
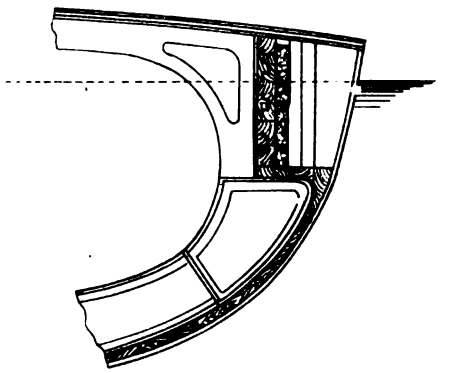
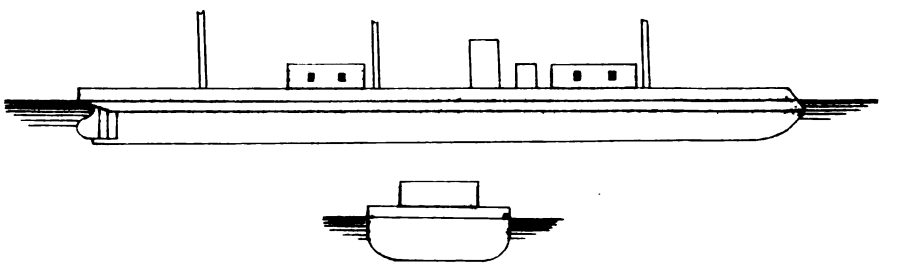
Deck of "Novgorod."



Side Armour of the "Vice Admiral Popoff."



"Smertz"



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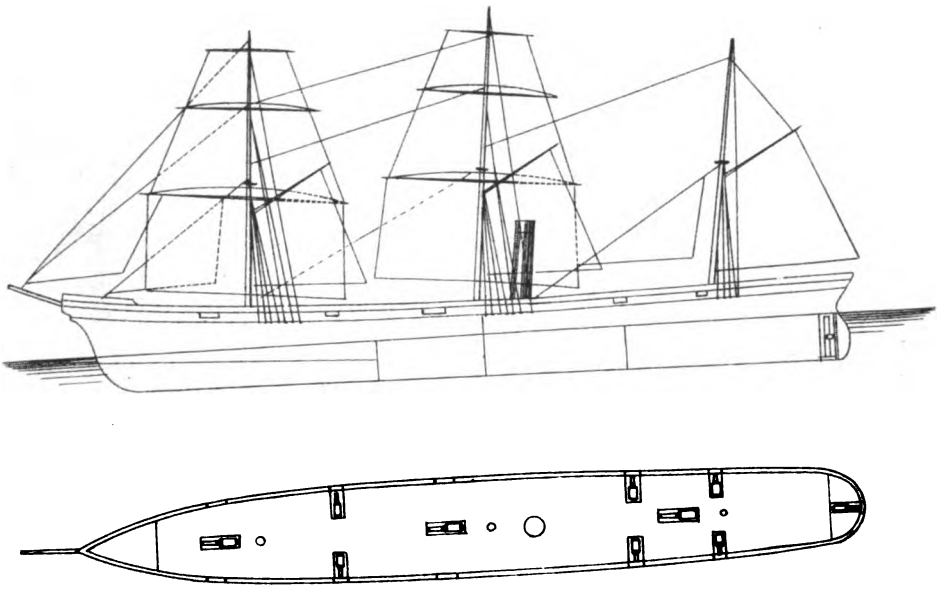
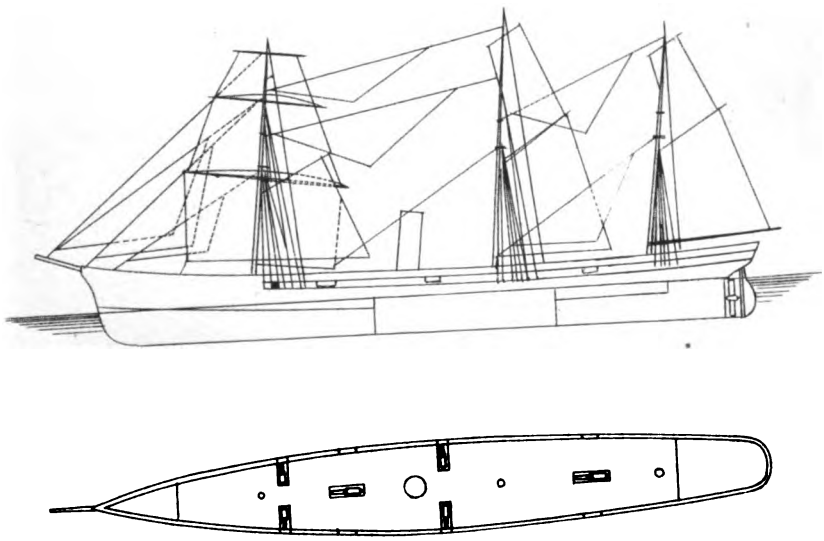
RUSSIAN SHIPS.

"Asia."



"Zabiyaka."



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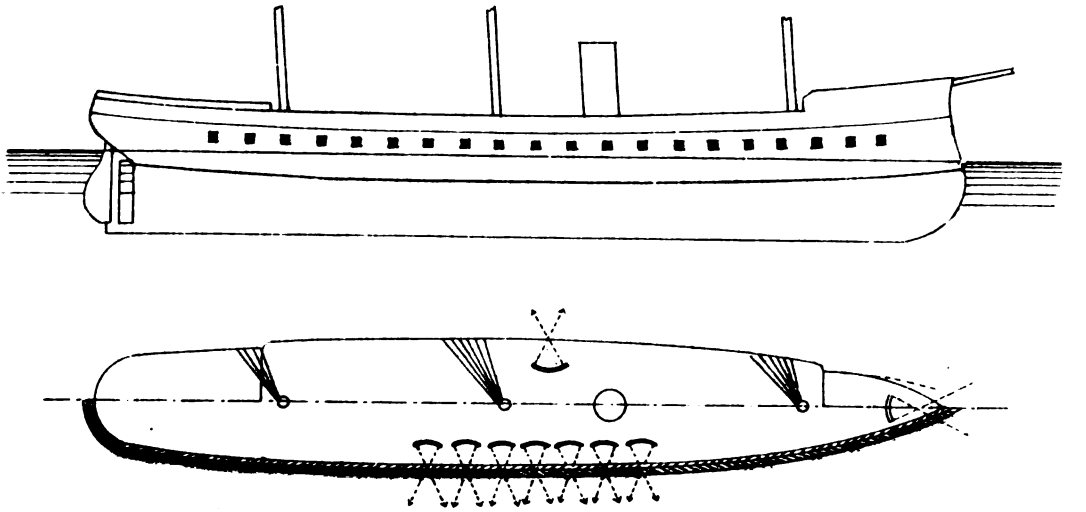
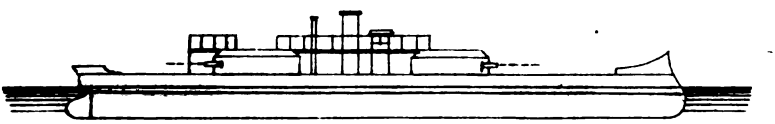
SPANISH SHIPS.

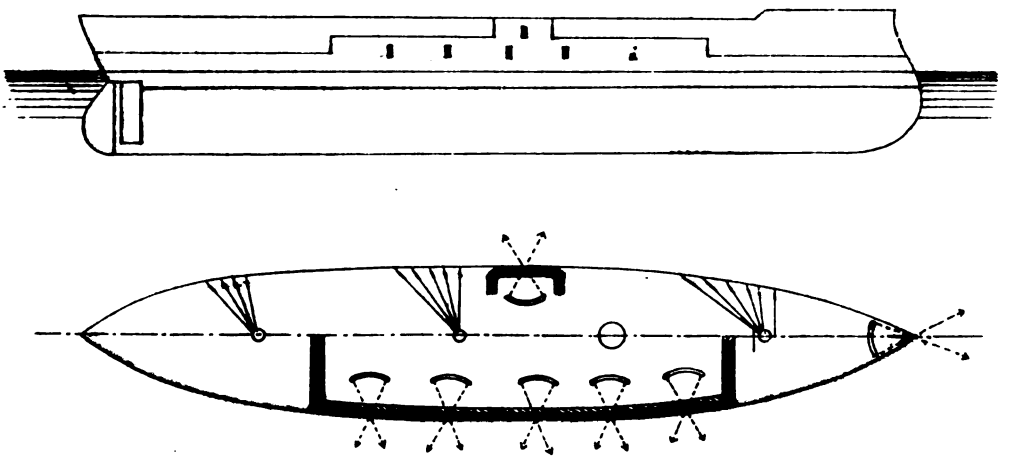
"Numancia".



"Puig-cerda".



"Sagunto".



MAYHANT LITH

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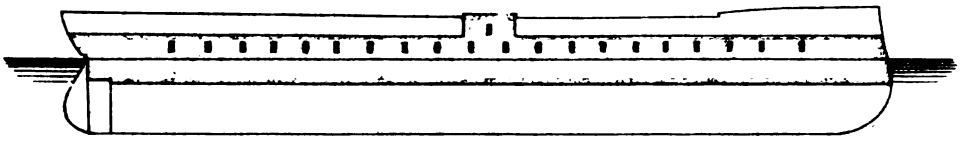
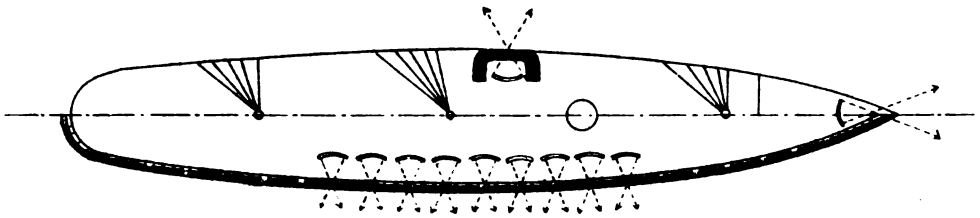
SPANISH SHIPS.

"Vitoria."





MANHAT. LITH.

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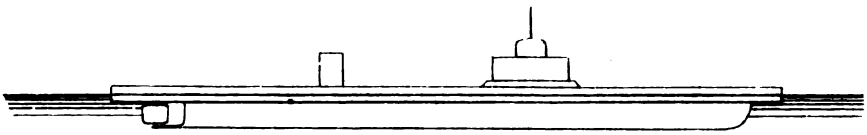
SWEDISH SHIPS.

"John Ericsson".



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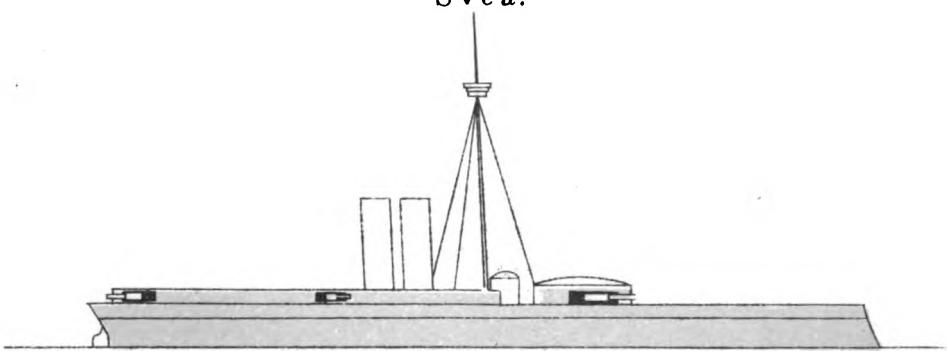

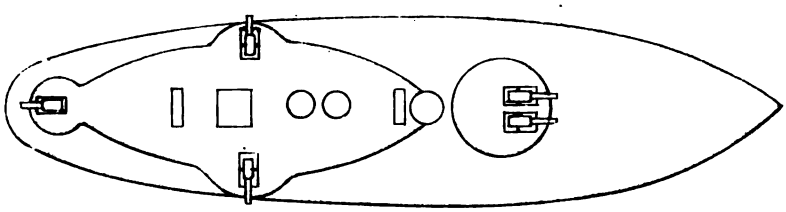

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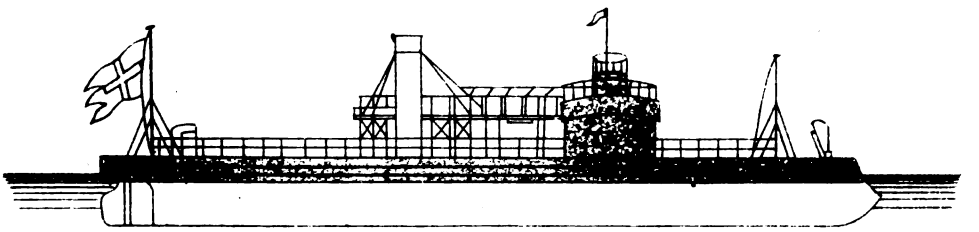
NORWEGIAN SHIPS.

"Mjolner & Thrudvang."



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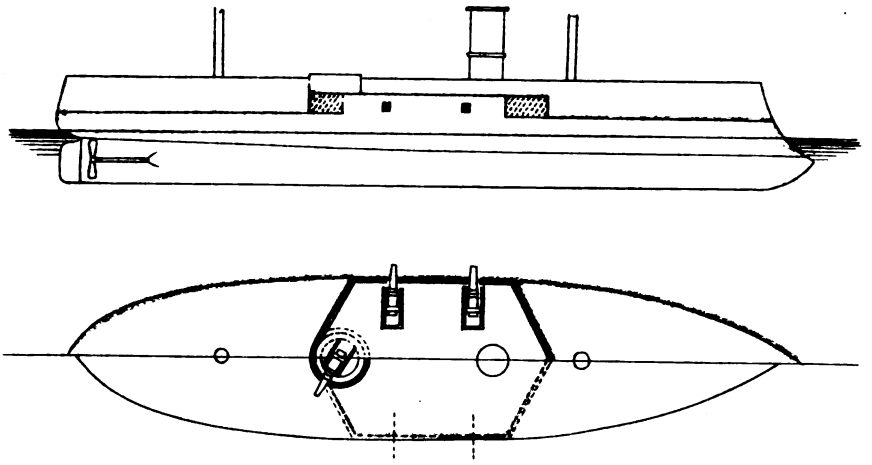
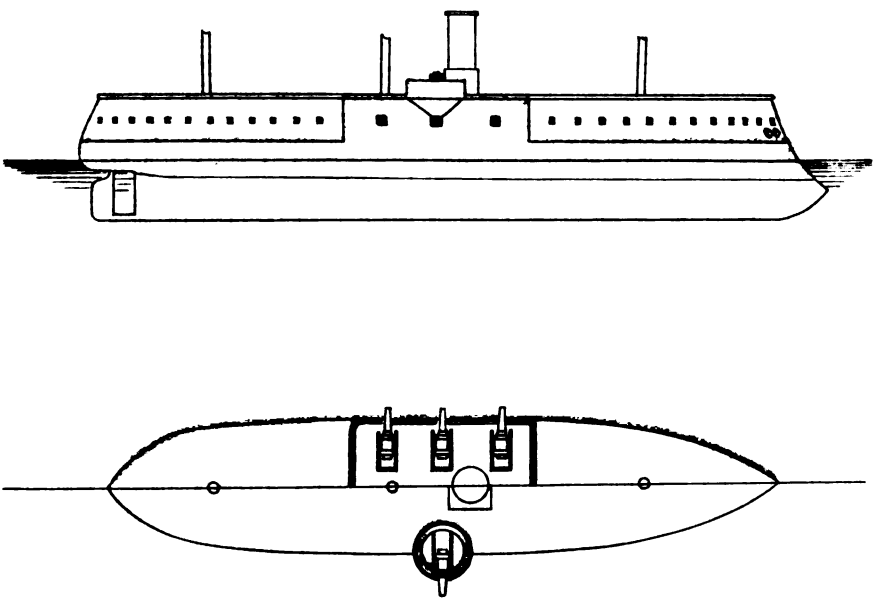
TURKISH SHIPS.

"Assar-i-Schefket."



"Assar-i-Tevfik."



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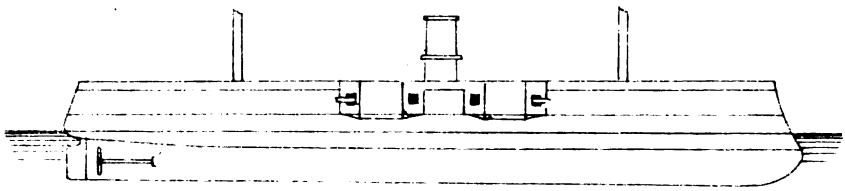
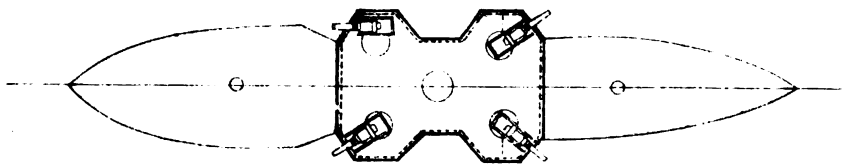
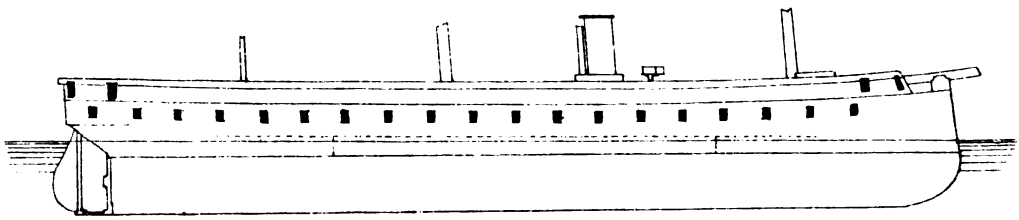
TURKISH SHIPS.

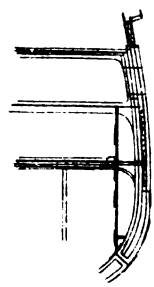
"Avni-Illah."





"Azazieh."





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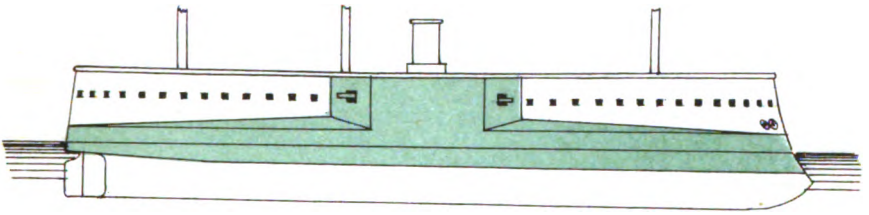
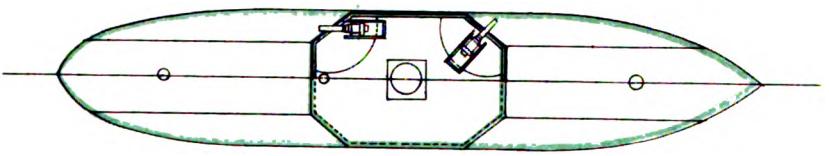
TURKISH SHIPS.

"Feth-i-Bulend".





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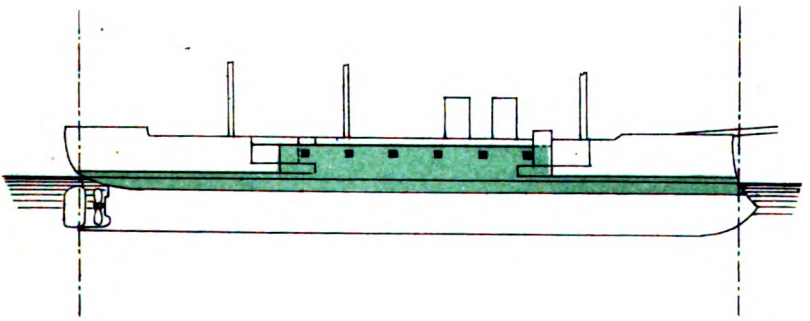

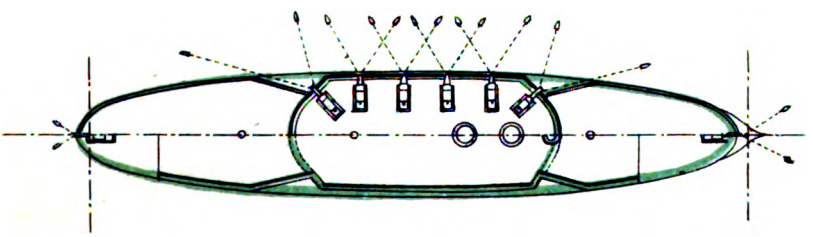

HANHART LITH.

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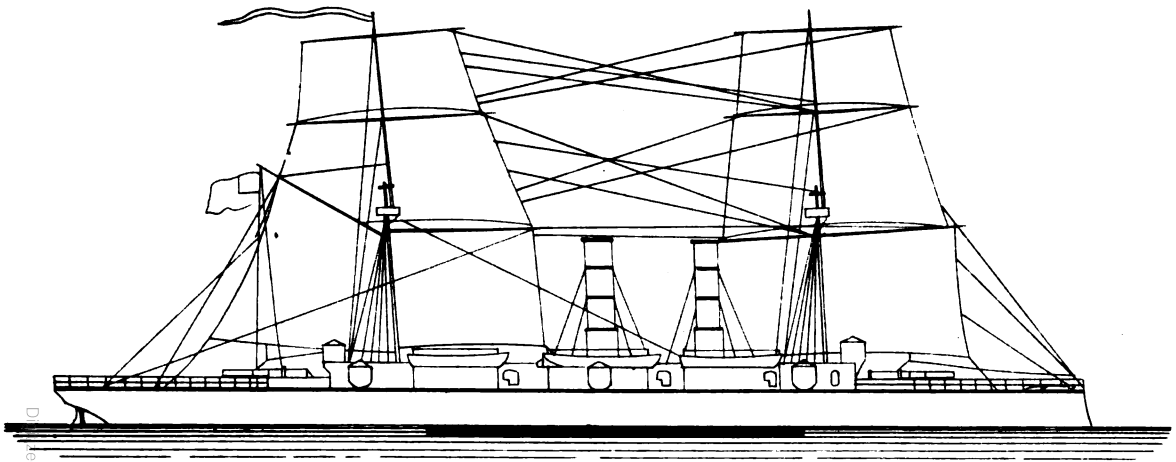
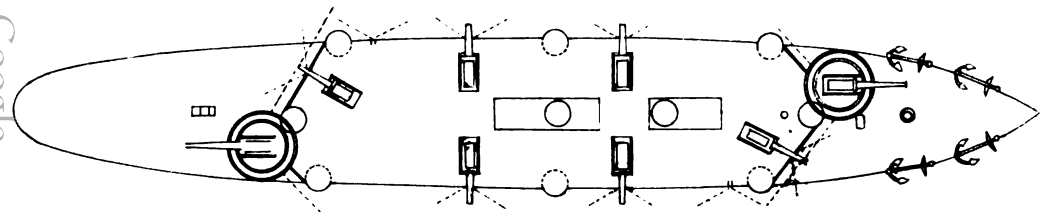
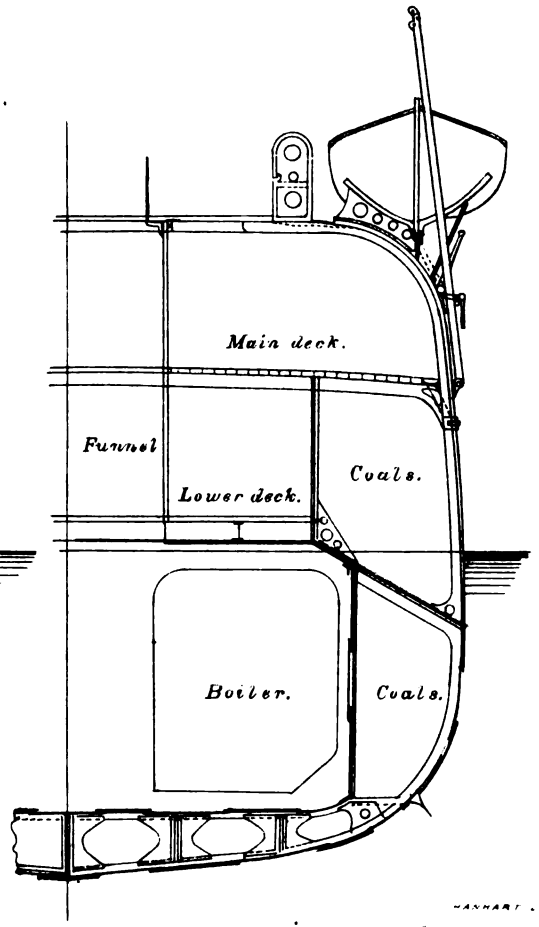
"Atlanta" & "Boston".







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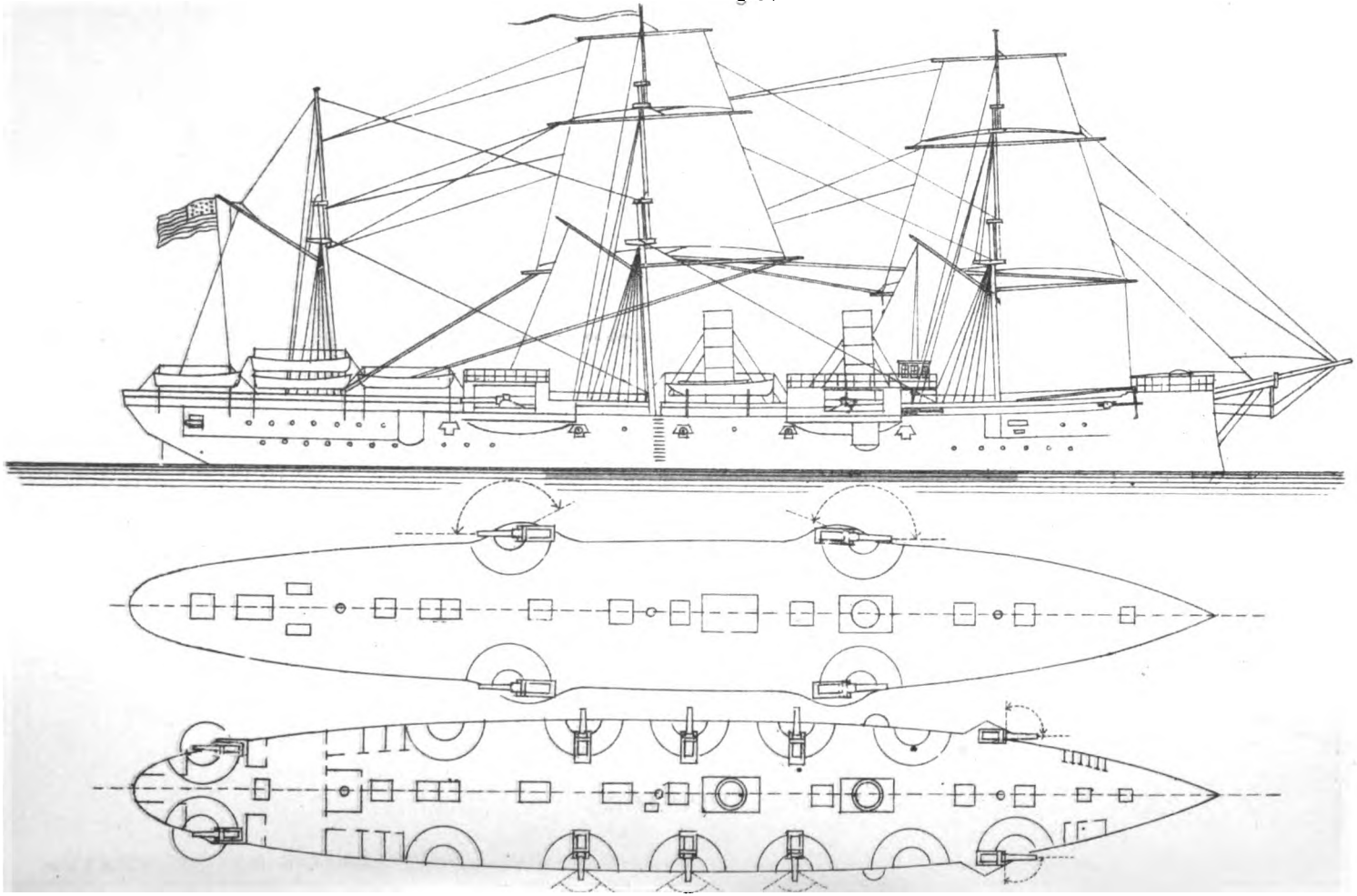

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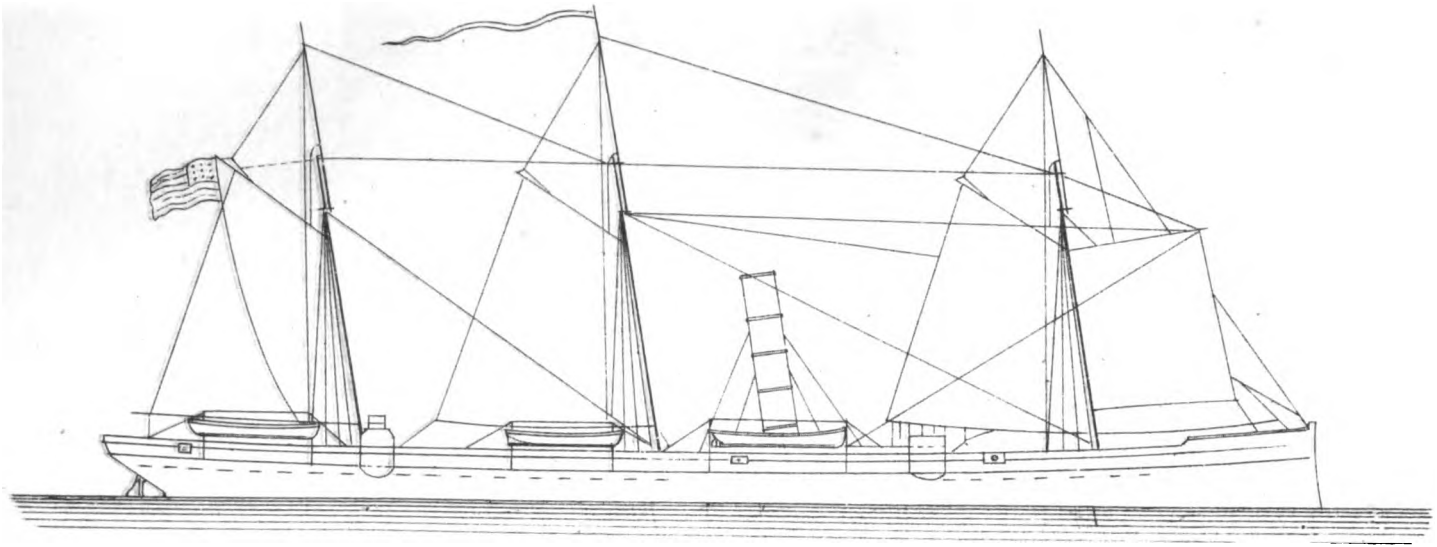
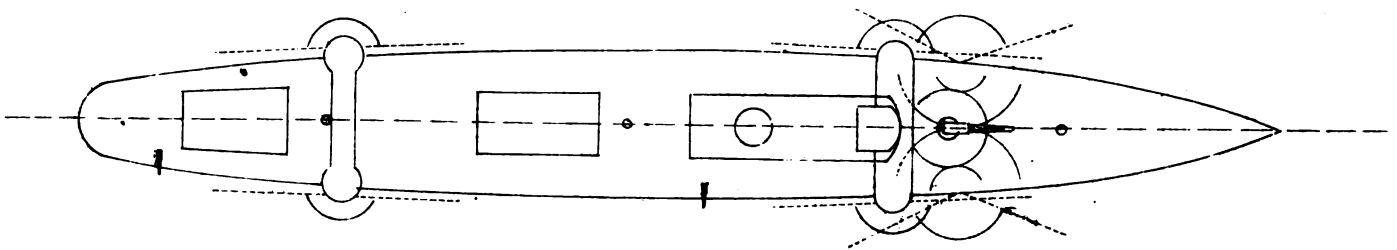
"Dolphin.





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SECTION III.

ARMOUR AND ORDNANCE

The following pages have been mainly compiled by CAPTAIN ORDE BROWNE, R.A., Lecturer on Armour at the R. A. College, Woolwich. Captain Browne has also supplied the Plates and Illustrations.

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ARMOUR AND ORDNANCE.

CHAPTER I.

Armour and Armour Experiments.*

The treatment of the subject of Armour, which appeared in Vol. II. of the *British Navy*, may probably be best continued so as to bring the information up to date, by noticing in order the principal occurrences of recent years, without attempting to weave them into a complete history, which would call for more space than can be afforded in this work. Consequently the following pages consist of brief accounts of experiments, notices of important papers read and decisions arrived at on various questions. Following these, will be found descriptions of English and Foreign Coast Forts obtained from General Inglis and Herr Grüson, and then some practical directions for the attack of armour, embodying rules which were drawn up for the Royal Artillery Handbook, and which underwent criticism and alteration at Shoeburyness and at the Construction Department of the Admiralty. Lastly will be found notes on the actual trial of armoured structures under fire. The figures and notes on the Huascar, given in Vol. II. of the *British Navy*, are reproduced in this section to which a few words on the Glatton turret trial are added, besides an account of the naval attack on the forts of Alexandria.

Experiments at Meppen, 1882.

In March, 1882, Krupp carried out a series of gunnery experiments at Meppen, in the course of which a 5·9-in. (15 cm.) gun was twice

* *List of Authorities.*—The Reports of experiments are abbreviated from the *Engineer*, and cuts are taken from the same source almost without exception.

'Recent Experiments with an 11-Inch Compound Armour Plate at Shoeburyness,' by Major O'Callaghan, R.A. R.A.I. Proceedings, 1882.

'Development of Armour for Naval Use,' by Lieutenant Very, U.S. Navy. Proceedings of U.S. Naval Institute, 1883.

'British Armour Defences,' by General Inglis, R.E. R.A.I. Proceedings, 1880.

Herr Grüson, Buckau, Magdeburg.

'The Effects of the Bombardment of the Forts of Alexandria,' by Major N. L. Walford, R.A. U.S.I. Proceedings, 1883.

'Official Report' for U.S. Government, by Lieutenant-Commander Goodrich, U.S. Navy, 1883.

Admiral Le Hunte Ward, R.N., C.B.

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fired direct at a target consisting of two 7-in. plates (17·5 cm.) of wrought iron with 10 in. (25 cm.) of wood between them (*vide* Figs. 1 and 2, Pl. I., showing horizontal section and front view). The shot was steel. It weighed 109·6 lbs. (49·7 Kg.). The first round was fired with a charge of 39·68 lbs. (18 Kg.), and the second 37·5 lbs. (17 Kg.) The range was 164 yds. (150 m.). The second shot had a striking velocity of 1750 ft. (533 m.). Its striking energy was 2328 foot-tons, and its calculated perforation would be about 11·65 in. of iron in one thickness, or 12 in. in two thicknesses, if sandwiched with about 5 in. of wood between them. The shot passed through the entire target, and went on up the range uninjured. The shot with higher velocity of course passed through still more easily. The plates were supplied from Sheffield. Figs. 1 and 2 show the perforations in them. The great effect of these shot may be accounted for by the following causes: (1) the intermediate wood was much too thick, so that the point of the shot got clear of the front plate before it met the resistance of the second. (2) The points were sharper than allowed for in the above calculation, namely ogival, struck with a radius of 2 diameters. The calculation is for 1½ diameters ogival. (3) Special excellence in the quality of the shot. There is no reason for finding fault with the iron plates which were apparently good.

Two rounds from the same gun were fired obliquely at an angle of 55° with the plate face, or 35° with the normal, against a plate 7·9 in. (20 cm.) thick with a backing of 9·84 in. of wood and 0·98 in. (2·5 cm.) skin. The firing charges were 39·68 lbs. (18 Kg.) and 37·5 lbs. (17 Kg.). Both projectiles perforated the target (*vide* Fig. 3, Pl. I.) completely, but both were broken up. The shot with the smaller charge had a striking velocity of 1750 ft. It had sufficient work to have penetrated 9½ in. at the striking angle, supposing the projectile to "bite" properly; but at so oblique an angle it has been found that the projectile has to be more than a match for the plate, generally speaking, to bite, and therefore there is no doubt that the penetration was unusually good.

Palliser Improved Projectiles.

On June 6th, 1882, Palliser projectiles (Figs. 4 and 5) of a special kind were tried at Shoeburyness. This projectile was intended to possess three advantages: (1) ribs to crack and open the plate; (2) steel jackets holding it together; (3) a reduced diameter involving reduced resistance to perforation. On June 6th, three projectiles were fired from a 13-pounder gun at a 4-in. steel-faced Cammell (Wilson's) plate. The shot struck with a velocity of about 1550 ft. This would perforate about 4·6 in. of unbacked iron. About 3⅔ in.

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KPUPP'S MEPPEN TRIALS, 1882.

HORIZONTAL SECTION.

FIG. 1.

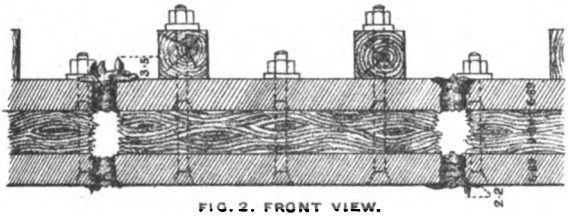


FIG. 2. FRONT VIEW.

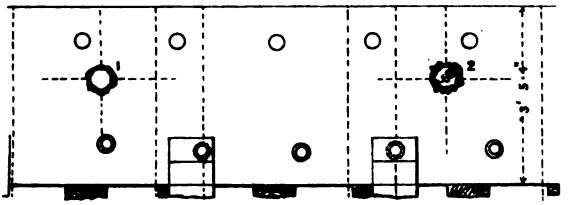
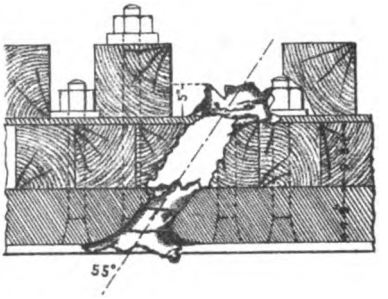
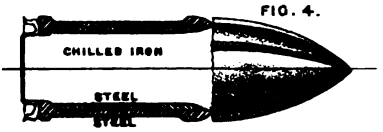


FIG. 3.



PALLISER IMPROVED PROJECTILES, 1882

FIG. 4.



RIBBED & JACKETED PALLISER SHOT, WITH FIXED UNDER JACKET & MOVEABLE UPPER JACKET.

FIG. 7.

FIG. 5.

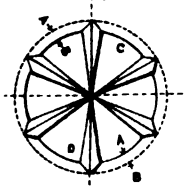


FIG. 6.

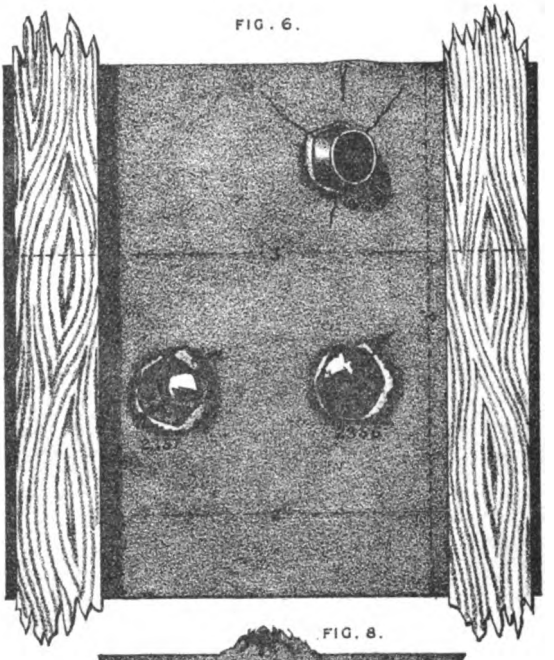
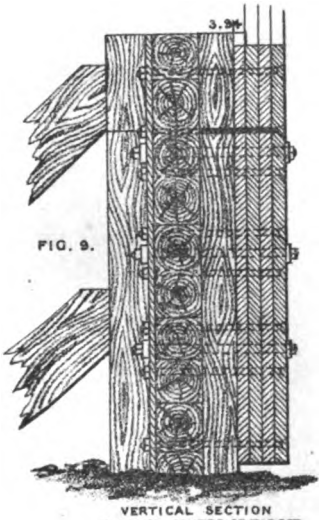


FIG. 9.



VERTICAL SECTION THROUGH CENTRE OF TARGET.

ARMSTRONG TRIAL, CADIZ 1884.

FIG. 8.

HORIZONTAL PROJECTION SHOWING OPENING AT BACK OF PLATE.

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of steel-faced plate would be considered an equivalent.* These three shot passed entirely through the plate (*vide* Figs. 6 and 8, Pl. I.), except that the double jacketed shot left its outer jacket in it. A service chilled shot fired in comparison broke against the plate-face, only bulging it in rear. The Palliser jacketed projectiles, so far, were remarkably successful, but it may be mentioned here that although they acted well against iron plates when fired from the 80-pounder gun in 1883, service chilled projectiles which improved in quality held their own or beat them, so that no further trial was made. The disadvantage at which a private individual is placed in manufacturing shot should be borne in mind in comparing his projectiles with those made in the Royal Laboratory.

Steel and Compound Armour.

Armour may be made so hard as not to admit of perforation at all. It must then be destroyed by shattering or racking. The plate in fact refuses to yield locally, and the work of destruction must be effected by breaking up the armour first, and firing at the exposed structure behind it afterwards. *Thus it is useless to apply calculations for perforation of soft wrought iron to the case of really hard armour.* Chilled iron, for example, cannot be perforated. Compound, or steel-faced armour, and solid steel, might be made to approach more nearly to the hard or soft class according to circumstances, as may be seen hereafter. The behaviour of shot in setting up on impact and disintegrating the layers of hard metal around it, is ably discussed in a paper by Major O'Callaghan, R.A., with quotations from Colonel Inglis, in the Proceedings of the Artillery Institution.† In this paper the peculiar behaviour of the metal shown in Fig. 2, Pl. II. is attributed to the metal neither rising upwards round the projectile, nor the plate bulging back. Hence forces are at work in directions radiating from the point of impact, and confined to the laminæ a few inches below the face of the plate. The steel driven in such directions finds relief by bulging upwards in the crater-like curves shown in the Figure. If the shot is soft, as was notably the case with the Gregorini projectiles fired at Spezia in 1882, the shot itself is driven to conform to the shape of these craters.‡ English chilled shot are harder, but steel projectiles set up, as shown in Fig. 1, Pl. II.

Major O'Callaghan's Paper.

The introduction of compound iron is dealt with in *British Navy*, Vol. II., pp. 9 and 19 to 21.

* This does not apply to armour which is too hard to perforate, and yields by racture.

† No. 2, vol. xii., 1882.

‡ *Vide* p. 300.

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Trial of Plates of Brown and Cammell, 1882.

As Brown & Cammell's compound plates are now largely adopted, it may be well to notice here the features distinguishing the two kinds of compound plates. Cammell's, made on Wilson's patent, consists of a foundation plate of wrought iron, constituting about two-thirds the thickness of the whole. On this, at welding heat, is run steel, which unites with it as described in Vol. II., p. 9. The whole is rolled down considerably afterwards, perhaps to half its thickness, * to give it fibre and toughness. Brown's compound armour, made on Ellis's patent, consists of a wrought-iron foundation plate, resembling Cammell's, but instead of making the face by casting steel on it, a thin rolled steel plate is placed at the necessary distance from the iron foundation plate, and the interval filled up with molten steel, which unites the steel face and iron foundation plate. The whole is then further rolled down as in Cammell's plate. By this means a face of the desired quality is secured, free from the liability to flaws of any kind, and with the continuity of surface so desirable in steel. Sir J. Brown & Co. have preferred this kind of plate to wrought iron when a bend at a sharp angle has been required. Both Cammell and Brown's plates have given excellent results in the experiments made to test the supply to the Navy and at Shoeburyness. One or two examples may be given.

A Cammell (Wilson's) compound plate, 8 ft. by 6 ft. and 11 in. thick, in a series of trials on board the Nettle, ending May 30th, 1882, received three blows from 9-in. projectiles, each weighing about 260 lbs. with a velocity of about 1420 ft., and a striking energy of 3636 foot-tons, and an estimated perforation of 10·7 in. of iron, followed by four blows from 10-in. projectiles, weight about 400 lbs., striking velocity about 1364 ft., energy 5160 foot-tons, and penetration of about 13·0 in. of iron. At the conclusion the plate was found to be cracked only to the depth of its steel face, and to have bulges at its back only $\frac{5}{8}$ in. high, with the 9 in., and $1\frac{1}{16}$ in. high with the 10-in. shot blows.

This plate, which is shown in Fig. 3, Pl. II., would have afforded complete protection to the structure behind it, and had a good deal of resisting power, after receiving about 31,548 foot-tons work, or 657·3 foot-tons work per sq. ft. of surface, or 3335 foot-tons per ton of plate.

A Brown (Ellis') compound plate, 10 ft. by $5\frac{1}{2}$ ft. by 11 in. thick, was fired at, at Shoeburyness in 1881 and 1882. It received four blows from 9-in. projectiles, three of which were chilled-iron and one

* See case of Cammells and Browns' plates at Spezia, p. 299.

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TRIAL OF CAMMELL'S & BROWN'S PLATES, 1882

FIG. 1.

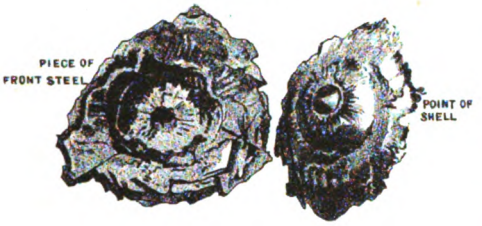


FIG. 5.

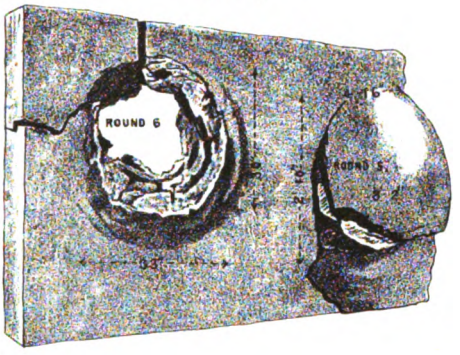


FIG. 3.

FRONT OF CAMMELL'S COMPOUND ARMOUR PLATE.

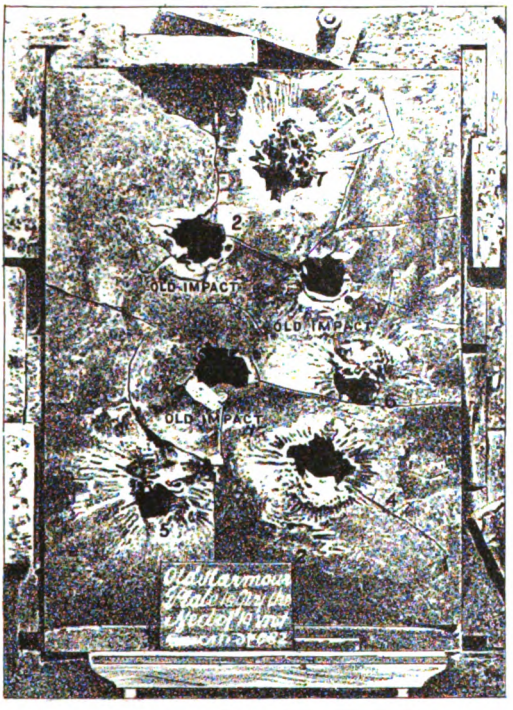


FIG. 2. SECTION THROUGH POINTS OF IMPACT.

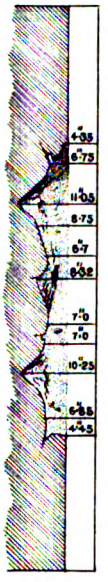
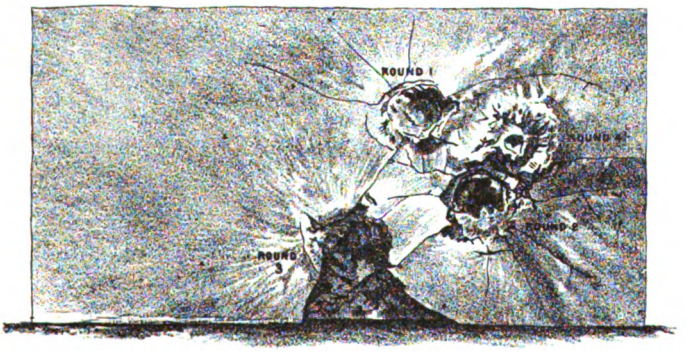


FIG. 4.



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SPEZIA COMPETITION, 1882.

FIG. 2
ROUND NO. 1.
FIRST ROUND AT CAMMELL'S PLATE.

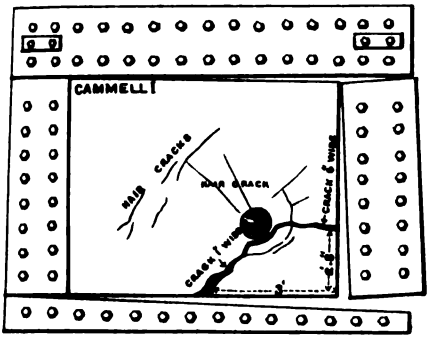


FIG. 5.
ROUND NO. 6.
SECOND ROUND AT CAMMELL'S PLATE.

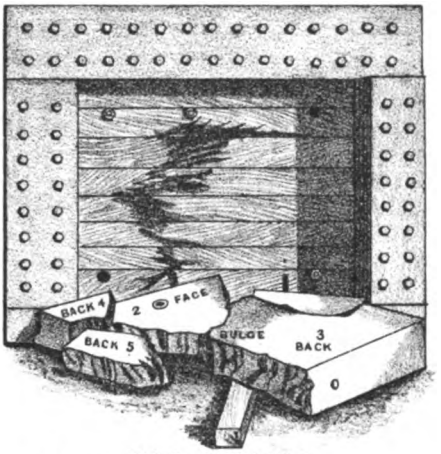


FIG. 4.
ROUND NO. 2
FIRST ROUND AT SCHNEIDER'S PLATE.

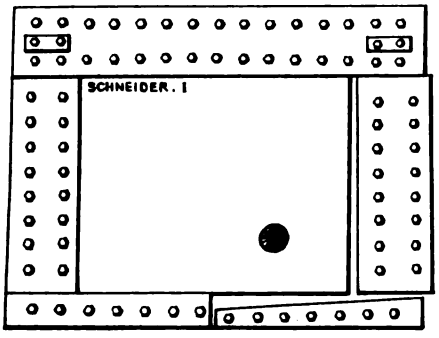


FIG. 7. ROUND NO. 4.
SECOND ROUND AT SCHNEIDER'S PLATE.

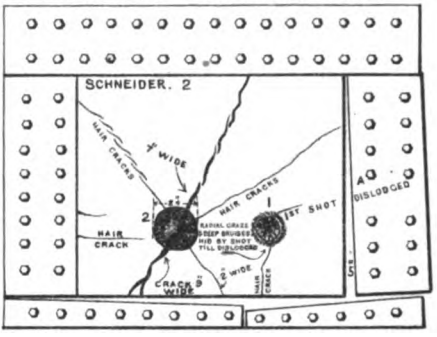


FIG. 3.
ROUND NO. 3
FIRST ROUND AT BROWN'S TARGET.

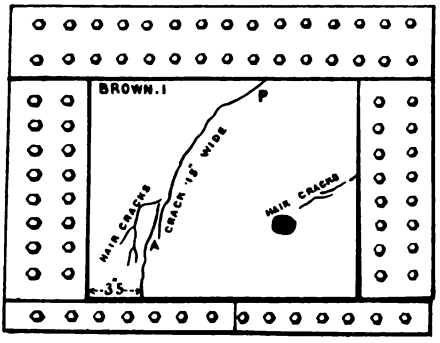
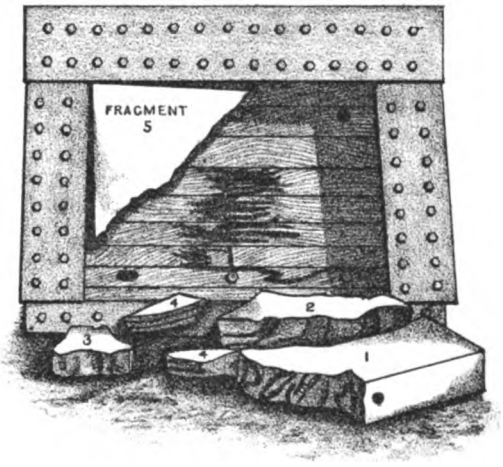


FIG. 6.
ROUND NO. 5.
SECOND ROUND AT BROWN'S PLATE.



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cast-steel, making up a total of 14,869 foot-tons energy. Its condition at this stage of the trial is shown in Fig. 4, Pl. II. Two rounds were then fired with the 38-ton 12·5-in. gun, cast-steel shells being employed. These had 11,824 and 11,695 foot-tons energy, making a total of 38,388 foot-tons, or 690 foot-tons per sq. ft., or about 3540 foot-tons per ton of plate, a large proportion of the projectiles being steel. This plate necessarily suffered much more than that last mentioned, the steel projectiles holding together and delivering their work at the point of impact, whereas the chilled projectiles shiver and deliver part of their blow in the form of langridge. Holes were made in this plate by discs of metal being torn out (*vide* Fig. 5), but not in a way that would have tried backing at all severely, the head of the projectile being set up as shown in Fig. 1. The back of the plate is shown in Fig. 5.

Compound armour, 5 ft. sq. and 18 in. thick, fixed in a powerful iron frame, was fired at in 1882 at Shoeburyness, by the 43-ton gun. The plate was overmatched and succumbed. The chief point to notice is the springing of the entire mass under shock of impact, which is important, as it concerns the transmission of a blow through compound armour into the supporting structure.

Spezia Competitive Plate Trials, 1882.

The Italian authorities having adopted for the barbette towers of the Italia and Lepanto plates of a thickness of 18·9 inches (48 c. m.), instituted a trial of such plates by means of the 100-ton 17·72 in. M.-L. gun, supplied by Sir W. Armstrong & Co. to the Duilio, the firing charge being sufficiently reduced for this purpose. The trial was partly competitive, for although the armour plates for the Italia had been already ordered from Messrs. Cammell, no decision had been taken as to those for the Lepanto. Three plates were tried, namely, one from Messrs. Cammell, one from Sir John Brown & Co., and one from Messrs. Schneider.

The dimensions of all were the same—18·9 in. thick, 10 ft. 10 in. long, and 8 ft. 7 in. wide (*vide* Pl. IV., Fig. 1, for section). Cammell's plate had a steel face made on Wilson's patent, and Brown's plate, one on Ellis's patent, the back of each being wrought iron, and the front, for about one-third the thickness, steel. The compound plates had somewhat hard steel faces, having from 0·65 to 0·7 per cent. of carbon in the steel. Schneider's steel plate, which was entirely of steel contained about 0·45 per cent. of carbon. It was not rolled. It was made from a very large pile 7 ft. thick, hammered down to 19 in. thickness under a 100-ton hammer. Schneider's target was held up with twenty bolts, and the others with six bolts each only. The bolts were of soft steel screwed into the backs of the

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compound plates to a depth of 4½ in., in screw holes 5¼ in. deep. The bolt had a plus thread and fitted the hole tightly, but the shank clear of the plate was reduced to about 3⅞ in. diameter. The rear end of each plate was secured by a washer screwed and holding against the back face of the backing. The screws in Schneider's plate entered only to a depth of 2¾ in.

The structure on which the plates were fixed is shown in Fig. 1, Pl. IV.

The projectiles employed in the first two rounds at each plate were of Gregorini chilled iron, 44½ in. long, 17·64 in. in diameter, with ogival heads 1¾ in. diameter radius, weight 2000 lbs. (907 Kg.). On November 16th the firing commenced. Precisely similar rounds were fired at each plate in succession.

The first round was fired with a charge of 328·5 lbs. and a 2000-lb. shot at a low velocity of about 1222 ft. Its stored-up work was 20,710 foot-tons. It was capable of penetrating about 19·33 in. of iron, that is to say, it was a match for the thickness of the target, had the target been iron. Each target being compound metal, it ought to have been equal to about 5 in. more, that is, to about 24½ in. of iron, and the shot was therefore not a match for it in penetration. The first shot being fired at Cammell's plate (*vide* Fig. 2, Pl. III.), the head was buried in it, and the cracks shown in the figure were made, the corner being detached. A similar round was fired at Brown's, the effect was less (*vide* Fig. 3); and the shot lodged in Schneider's plate apparently without making the slightest crack anywhere (*vide* Fig. 4).

The next round was fired at each with a charge of 478·3 lbs., having sufficient work to perforate the targets; that is to say, the shot had enough work in it to perforate 24·7 in. of iron or about 19 in. of compound armour. The stored-up work was 33,100 foot-tons. The effects produced are shown on the diagram. Cammell's plate was broken up (*vide* Fig. 5) and brought down, the bolts giving way. In the same way a shot was fired at Brown's plate and brought down part of the target; one corner remained, hanging by a bolt (Fig. 6). The second round at Schneider's produced the effect shown in Fig. 7. The apparent difference between those results is very great, and is mainly due to the fact that Schneider's target is well held up by bolts, whereas the other targets not being sufficiently bolted, fell on the ground, but, besides this, Schneider's plate held better, and the steel had a fibrous tough look about it. A steel projectile was then fired, thought to be a Whitworth, but afterwards said to be a Terre Noire projectile. It weighed 2078 lbs., and it had a striking velocity of 1538 ft. and about the same stored-up work

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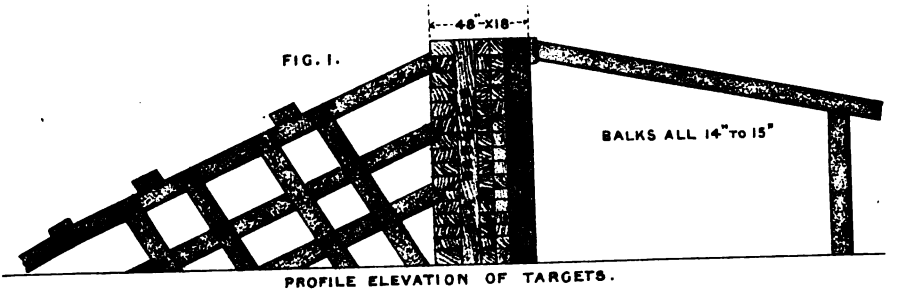
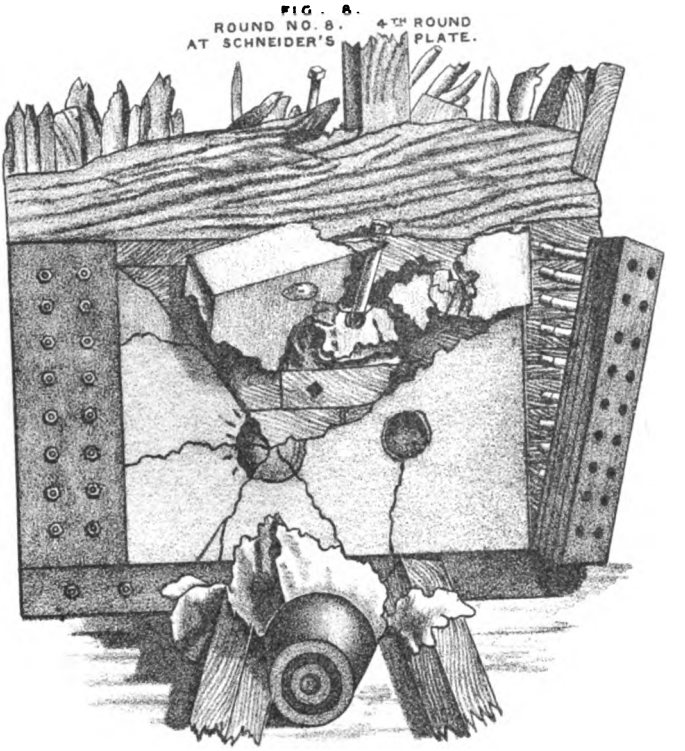
SPEZIA COMPETITION, 1882.

FIG. 1.



PROFILE ELEVATION OF TARGETS.

FIG. 8.
ROUND NO. 8. AT SCHNEIDER'S



OCHTA COMPETITION, 1882-1883.

FIG. 9.

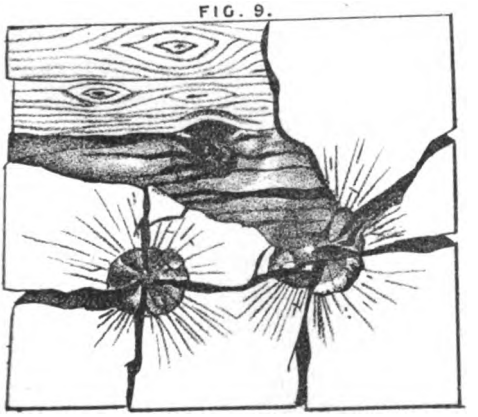
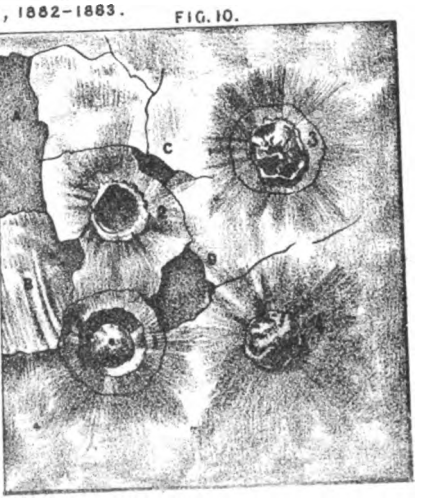


FIG. 10.



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as before, viz., 34,080 foot-tons—about a match in penetration for the target. A great piece of steel was brought down, the projectile was flattened and bounded back, the top frame round the target was thrown to the front so as to overhang the face.

One more round was fired. The result is shown in Fig. 8, Pl. IV. The projectile was a San Vito cast-steel shot, and broke in a very different way to the last mentioned. The head appeared good, but the body bad: the difference being accounted for by the head having been tempered in oil.

Ochta Competitive Plate Trial, 1882.

On November the 24th, 1882, that is, while the Spezia experiments were being carried on, a trial was commenced at Ochta, near St. Petersburg, between Cammell's (Wilson's) steel-faced and Schneider's steel plates. In each case, the first blow delivered was the heaviest. An 11-in. breech-loading gun was fired at 12-in. plates, 8 ft. by 7 ft., and the striking velocity of the first round was 1506 ft., the charge being 132 lbs. English; the weight of the shot was 553½ lbs., the work in the shot was 8704 foot-tons, and the power of perforation equal to about 16·3 in. of iron—just about a match for the target. The first round fired at the Schneider plate cracked and broke it. The next was fired with 81 lbs. of powder, striking with a velocity of 1167 ft. and 5228 foot-tons work; it had a power of perforation of 12·21 in. of iron; and the third, with the same, broke a quarter of it away (see Fig. 9, Pl. IV). The Schneider plate on this occasion again was bolted up with many bolts, whereas the Cammell had only four. The first round being fired at the Cammell plate with a charge, &c., corresponding to the first round at the Schneider, the projectile broke up, as in the previous rounds. The head remained embedded in the plate, and very slight cracks were made. The next round, fired with a charge, &c., as in the second round at the Schneider plate, detached the plate, which fell on its face. On being again mounted and fired at on March 8, 1883, with the same reduced charge, it eventually received in all four shots planted on it; the result is shown in Fig. 10, Pl. IV.

In this case there is no doubt the Cammell compound plate beat the steel plate; but in the case of Spezia, the steel was the better of the two. The fact that the scale on which this steel plate was successful was a larger one must be borne in mind. An 18-in. plate is a much greater manufacturing achievement than one of 12 in. thickness.

At Ochta, the Schneider plate received in all 19,160 foot-tons, energy delivered on it in 3 blows—making 1564·4 foot-tons per ton of plate. The Cammell had received 24,388 foot-tons energy in

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four blows, or 1991·3 foot-tons per ton of plate, taking the weight of each plate at 12¼ tons.

Admiral Acton on Spezia Trials, 1882.

His Excellency Rear-Admiral Acton, the Italian Minister of Marine, made an able speech in the Chamber of Deputies in Rome, on April 12th, 1883, defending the preference entertained in favour of compound armour rather than steel, by himself and the Italian authorities, in spite of the results of the trials at Spezia, of November, 1882. For this he gave the following reasons:—

1st. The imperfect bolting and soft backing placed the compound plates at a disadvantage, and did not represent such rigid support as would be afforded by a ship's side.

2nd. The projectiles of medium or small guns were found, in supplementary trials to that above described, to enter the steel plates, while they would be broken up by steel-faced armour, and would be well thrown off when striking obliquely.

3rd. At Gâvres and Ochta much better results were obtained from the compound armour than from the steel.

4th. Neither the English, Russian, German, Austro-Hungarian nor the French Government have been induced by the results of the Spezia trials of November to give up their faith in compound armour.

5th. When armour remains attached to its backing, although broken, compound plates behave better and offer more resistance than any others.

He admitted that if the face of steel could be successfully hardened it might possibly be most successful in the future. Either Schneider or compound armour would efficaciously protect the turrets, smoke stacks, &c., of the Italia from the fire of the 100-ton gun, but shot from smaller guns would be more likely to injure the Schneider plate than the compound. As regards the test adopted at Spezia, Admiral Acton suggested that the most severe test for fracture was the impact of a heavy projectile on the centre of a plate, which has more effect than blows delivered near the edge. The bolting was no doubt better tested by two shot near the plate edge, but the question at issue was not so much bolting, as resistance of plate. The English Admiralty had, like the Italian Government, adopted the system of striking the centre to test the plate.

Admiral Acton then quoted conditions of trial demanded by Schneider, in case a lot of their armour had to be tested, conditions which the Italian Commission could not admit. Admiral Acton dwelt upon the objection on the part of Messrs. Schneider to a central blow, with power to deliver a second if necessary.

In short, Schneider, Cammell and Brown, had all made reserva-

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tions against the test proposed by the committee, that is, three shots each with 217 kilogrammes (478·4 lbs.). Messrs. Brown and Cammell had declared their willingness to accept the tests demanded by Schneider in a letter March 5th. Admiral Acton finally maintained that he had prudently and deliberately accepted the superiority of compound armour. He then read the opinion of the Committee, which was as follows: "The Committee having heard the foregoing report, unanimously express the opinion that for armour of great thickness for the Italia, compound plates should be adopted, and that the supply should be divided in about equal parts between the two firms of Cammell & Co. and Brown & Co.; this giving the only sufficient guarantee of good manufacture, and by the expedient of dividing the total quantity required into two parts, the best means are obtained of hastening the supply of the armour."

Finally, Admiral Acton quoted the opinion of Admiral Schwatz, head of the Russian Artillery, and Admiral Schestakow, Minister of Marine, that, notwithstanding the Spezia tests in November, and those made in Sweden, "compound plates are superior to the Schneider."

Deck Armour Experiments.

A preliminary experiment of a rough character with regard to 2 in. of deck-armour, inclined at 15°, was made at Eastney in Sept., 1881. On October 23, 1882, and afterwards on December 20, 1883, deck targets consisting of 3 in. of iron or of mild steel, were fired at Eastney, laid on in two or three thicknesses, but not exceeding 3 in. in all. The 10-in. and 9-in. old type Woolwich guns were employed with 70 lb. and 50 lb. charges, with Palliser and common shells. The decks were inclined at 10° to the line of fire. Common shells could not be depended on to burst with G.S. or R.L. fuzes. Palliser shells generally broke on impact, but produced more effect than common shells, except in the case of a few of the latter which burst, though other common shell which burst produced little or no more effect than those which broke up. All projectiles were deflected, and even when holes were made in the deck, the latter had furnished sufficient resistance to deflect most of the common shell.

Coal Protection.

Experiments* to determine the resisting power of coal against artillery fire were conducted in 1880 by the Committee on Ordnance, of which the late General Gordon, C.B., R.A., was President, when the following conclusions were arrived at:—

Twenty feet of coal, or seventeen to sixteen feet of coal with a 1½-inch steel plate inserted, will resist 6-inch gun chilled iron projectiles at short ranges.

* The results of these experiments were not given in the D. of A. Proceedings, but in a special Report printed March 29, 1881.

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Thirty feet of coal, or twenty-five feet with a plate, will resist 8-inch chilled projectiles. Steel projectiles would probably have greater perforation, the chilled shot breaking up. Live common shells had little effect and no incendiary action.

Two feet of coal here appear to be equivalent to about 1 inch of iron; but obviously, while this may give a general notion of the power of coal, no rule can be based on it. The mechanical law which causes the resistance of iron to vary as the square of its thickness cannot apply to coal.

Whitworth Experiment on Perforation.

In August, 1883, at Southport, Sir Joseph Whitworth fired a forged steel shell weighing 403 lbs. from a 20-ton 9 in. gun, 29 calibres long, at an 18 in. wrought iron plate, strongly supported behind by an iron cylinder or hoop, forming a sort of tunnel, filled with rammed wet sand, the plate resting against it, as shown in Fig. 12, Pl. V. Against the opposite end of the cylinder was a $1\frac{1}{8}$-in. plate and wood backing, with steel angle-plates, and a large cast iron bed-plate rested nearly horizontally against it, buried deep in sand. The projectile had a striking velocity of about 1900 ft. per second, and a striking energy of 10,090 foot-tons, or 357 foot-tons per inch circumference, and a calculated perforation of 19·81 in. The projectile passed through the plate and down the tunnel, breaking up the bed-plate and then glancing downwards. The point of the projectile was slightly distorted, but it was in other respects but little damaged. The chief point to notice is the excellent behaviour of the steel projectile.

Engineer Plate Experiment, 1883.

On Tuesday, August 22, 1883, an experiment of great interest, especially to England, took place at Shoeburyness. It was carried out by the Royal Engineers with a view to testing the amount of protection afforded to granite forts by iron plates. The general nature of the work tested is shown in the accompanying sketches (Figs. 1 and 2, Pl. V.)

The shields fixed on the face of Portions II. and III. were as follows:—That on No. III., against which the first shot was to be fired, consisted of two plates of 8-in. thickness each, of wrought iron, sandwiched with 5 in. of wood behind each, made up of two thicknesses, that is, $2\frac{1}{2}$-in. planks laid horizontally, next behind each plate, and $2\frac{1}{2}$-in. planks behind them placed vertically. The dimensions of each plate were as follows:—Length, 12 ft.; height, 7 ft.; and thickness, 8 in. They were supplied by Messrs. Cammell. They were held in their place by six bolts, on the Palliser English system.

The shield on Portion II. consists of 12 in. of Wilson's steel-faced

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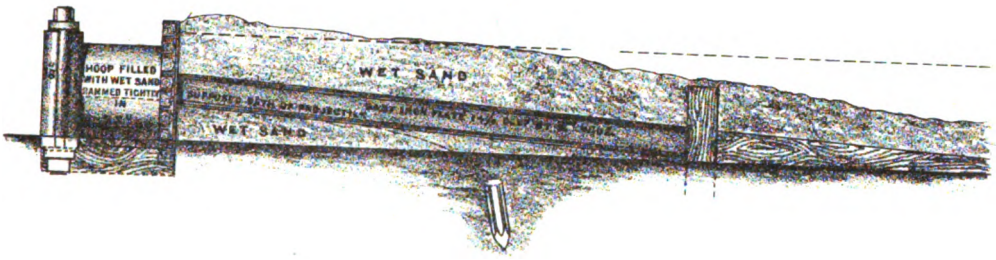
TRIAL WITH THE WHITWORTH 9-INCH BREECH-LOADING GUN.

FIG. 12



ENGINEER PLATE AND MASONRY TRIAL, SHOEBURYNESS, 1883.

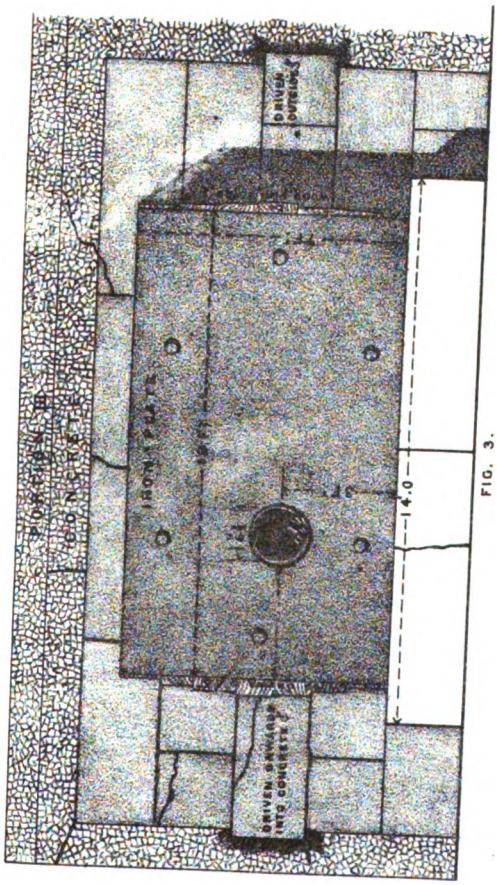


FIG. 3.

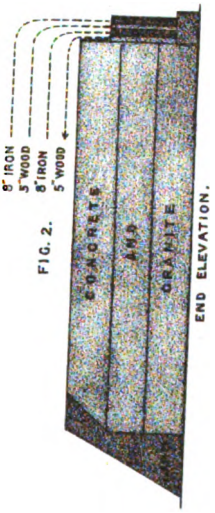


FIG. 2. END ELEVATION.

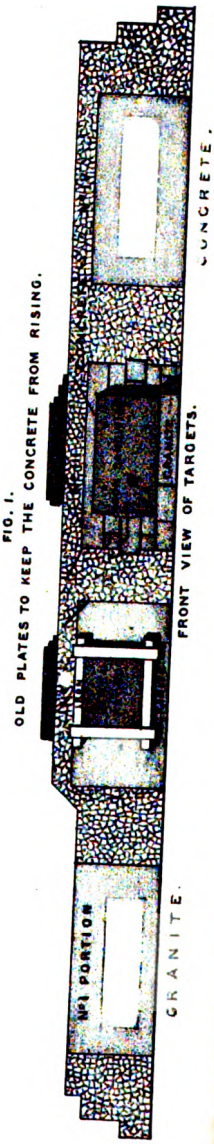


FIG. 1. OLD PLATES TO KEEP THE CONCRETE FROM RISING.

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iron, in a plate 7 ft. by 7 ft. held up by four bolts, fixed inside an iron frame, as shown in Fig. 1, Pl. V. Structures of concrete would hardly attain their full strength for many months, perhaps years to come, and allowance must be made for this in considering this trial, which it will be seen was a very severe one.

The gun employed was the 80-ton gun, M.L., which was mounted at 200 yards distance. One round was fired from it at Portion III. —iron sandwich on granite. A projectile weighing 1700 lbs. was fired with a charge of 450 lbs. of pebble powder, with a velocity of 1588 ft. This implies a total amount of stored-up work of about 29,730 foot-tons, or 594·4 foot-tons per in. circumference, representing a power of perforating about 25 in. of iron. The shot, a service Palliser chilled iron projectile, was fired without bursting charge. The shot struck a point 3 ft. from the bottom of the plate and 3 ft. 8 in. from the left end looking at it. The effects were as follows :—The shot cut a clean hole, passing through both plates, and breaking up during penetration, turned rather to the left, the point reaching a depth of nearly 10 ft., measuring from the front face of the iron. The plates behaved admirably, the hole being cut almost without any apparent effect in the surrounding portion of the plate. The wood was driven outwards. The granite was pulverised all round the projectile for some distance. Cracks were visible in the granite in front, as shown in Fig. 3. One or two cracks also were visible in the brickwork lining of the small cross passage behind the part struck. The bolts do not appear to have suffered, and the general structure shows little effect beyond what is here mentioned.

A velocity of 1100 ft. ought to be sufficient to enable this projectile to perforate 16 in. of iron alone.

England is the only Power that has employed wrought iron to any considerable extent in coast forts, chilled cast iron having come in generally abroad. An experiment, therefore, that shows that wrought iron behaves well is specially satisfactory to us as a nation, and surely this is the case here. The iron offered a great resistance, and it suffered only locally. The latter fact is, of course, important as affecting the further powers of resistance of the fort. Fig. 10, Pl. VI., shows the fragments of shot assembled.

The second round was fired on September 11th at Portion II., the steel-faced plate, &c. The projectile was in this, and in every other case, a Palliser shot weighing over 1700 lbs., the striking velocity being something under 1600 ft. The effect is seen in Pl. VI., Figs. 7, 8, and 9, which show the plate, and in Fig. 4, which shows the masonry

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behind it. It will be seen that the plate stood wonderfully well. The shot broke up, its head being fixed in the plate. (See Figs. 7, 8, and 9.) The plate was bent and bulged, the bulge and shot being pressed unusually flat against the masonry supporting the plate. There were great annular rents immediately round the shot, where much violent work must have been done, the radial cracks were nearly all fine hair cracks—the depth of the most important may be seen in Fig. 9. The bolts stood well, holding the plate up. They were subsequently broken to enable the back of the plate and masonry to be examined. Fig. 4 shows the granite with the indentation and cracking made by the blow. This, it may be seen, is very slight (*vide* A in Fig.) The spring of the plate has opened the joints at the upper bolts, B B, and if the side view (Fig. 9) be examined, it will be seen that a tremendous strain must have fallen on these bolts.

Taking this round as nearly the same as No. 1, it may be noticed that about 30,000 foot-tons work have been delivered on this shield, and that a compound 12-in. plate has, under the conditions presented, borne the blow of a shot capable of perforating about 25 in. of iron.

How is this to be accounted for? The plate with its hard surface and hard backing resisted the shot very sharply and rigidly: this, being a chilled shot, broke under such a shock much more easily than a good steel shot would do. The plate had been cracked from the front to a depth of 9½ in. at the edge, as shown in Fig. 3, but the shot was unable to bend it back and tear open the remaining thickness from the opposite side, and so the blow was borne.

The Portions at the extreme ends, Portions I. and IV., consisted wholly of masonry.

Portion I., 40 ft. thick in all; the front was of granite, 5 ft. thick, then came 13 ft. of concrete, next to that 5 ft. of granite, and behind it concrete. Portion IV. consisted wholly of concrete.

Round 3 was fired at Portion I. The projectile with about the same energy as the previous rounds, entered the masonry about the spot marked A in Fig. 5, dislodging and breaking the stones in the vicinity, and penetrating through the front, 5 ft. of granite and 13 ft. of concrete, kept a fairly direct line until it met the second granite layer. Then after chipping the face of the granite it turned sharply to the right, broke, and soon came to rest, having gone straight in for about 18 ft. and then laterally about 7 ft. Fig. 5 shows the upper stones removed. The concrete may be seen to be opened upwards and broken considerably. Fig. 11 shows the fragments of the shot assembled.

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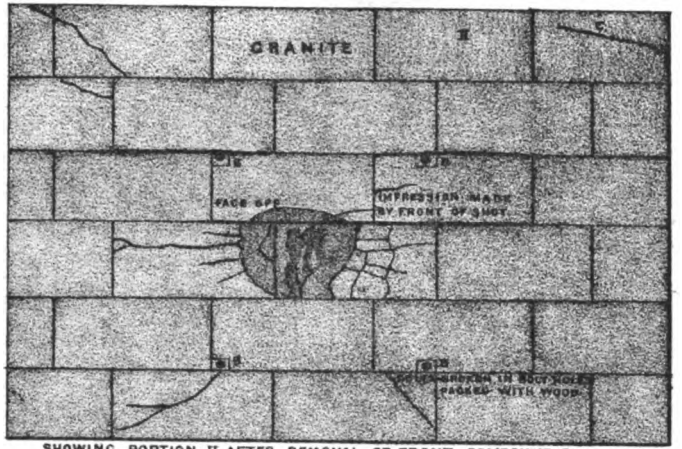
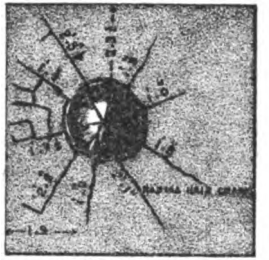
FIG. 4.



SHOWING PORTION II AFTER REMOVAL OF FRONT COMPOUND PLATE.

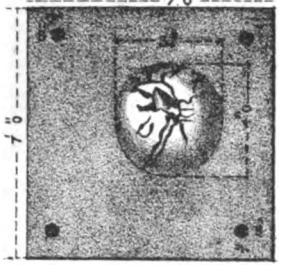
FIG. 9.

FIG. 7.



STEEL FACE.
CAMMELL'S (WILSON'S) COMPOUND PLATE
FRONT VIEW, REMOVED FROM PORTION II.

FIG. 8.



IRON BACK.
CAMMELL'S (WILSON'S) COMPOUND PLATE
BACK VIEW.

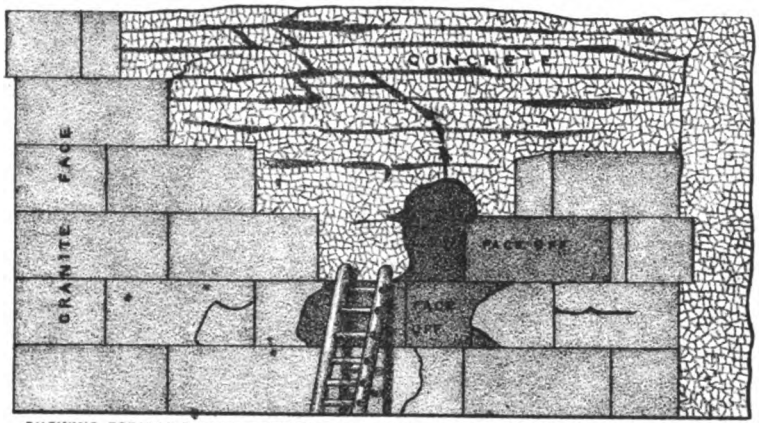
FIG 10.

SHOT FROM WROUGHT IRON PLATE
PORTION III.

FIG. 11.

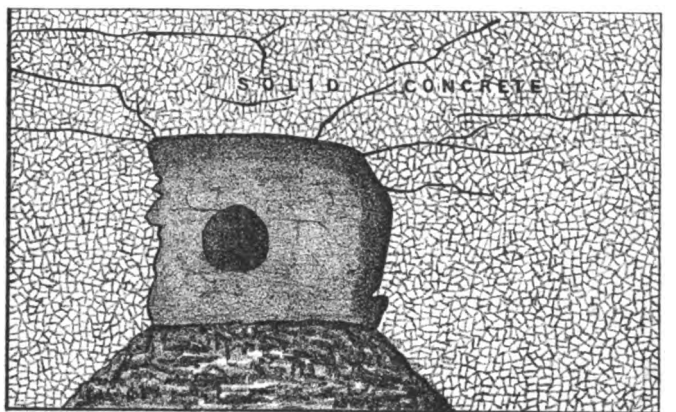
SHOT FROM GRANITE
PORTION I.

FIG. 5.



SHOWING PORTION I AFTER REMOVAL OF GRANITE BLOCKS ABOVE POINT OF IMPACT
SHOWING GENERAL CONDITION OF CONCRETE.

FIG. 6.



SHOWING HOLE WHERE SHOT ENTERED WITH CONCRETE IN PROCESS OF REMOVAL ROUND IT TO GET OUT SHOT. PORTION IV.

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Round 4, resembling those previously fired, was at Portion IV. (concrete only). The projectile penetrated to a depth of about 30 ft. Fig. 6 gives the front view of the structure.

The effect of the front plates in protecting the masonry was considered very good, especially, of course, in the case of the compound 12-in. plate.

Very on Armour.

A remarkably able history of the introduction and use of armour was written by Lieut. Very, U.S. Navy, as a prize essay for the United States Naval Institute for 1883. It is a work of about 240 pages with numbers of illustrations. General principles are well handled. Many of the most important European armour trials are discussed. These are chiefly based on reports published in European papers, notably the *Engineer*. Certain experiments, however, conducted in Denmark and at Gavres are given which are little known, and American trials and effects produced on service are well described and illustrated. The experience obtained in the American war with the Monitors and earlier forms of ironclads is valuable rather for lessons as to construction, than for any practical guidance to combatant officers, as such vessels will now hardly be encountered on service. His opinions, Very expresses in vigorous plain language, for example: "Up to 1868," he writes, "the Woolwich gun had no equal, but English artillerists are alone to blame for the ground lost between 1868 and 1878, that sent their guns from the foremost rank to the rear in everything except diameter of bore." "When the Krupp breech-loader overpowered the Woolwich gun at Tegel in 1868, the English obstinately closed their eyes to the lessons of the long bore high charge, prismatic powder, and tight-fitting projectile." "Steel was condemned at Woolwich apparently more because Krupp was a successful rival of Armstrongs than for any other reason." The U.S. Authorities are freely condemned for obstinacy in supporting the S.B. cast-iron guns, and in converting them after cast-iron had obviously been played out—"When no country, be it even half civilised, will purchase a gun having cast iron on it." The chapters on "Manufacture and Laws of Penetration of Armour" are, like the rest of the book, very good. Here and there, however, a slip occurs. For example, on Grüson's chilled forts, Very remarks, that "all nations are actively engaged in the construction of this type of defence for their frontiers," and "It will be readily seen what great advantages are realised in the application of this chilled metal to inland fortifications." This is a mistake, for owing to its yielding to the continued attack of *steel* projectiles, chilled iron is almost solely used for coast forts. Very's work will be found more interesting reading than one

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which from an official character is prohibited from such free expressions of opinion.

Copenhagen Plate Competition.

On March 20 and 21 a competitive trial of steel and compound plates took place at Amager, near Copenhagen.

The following is a brief summary of what took place:—

The plates were all 6 ft. 6½ in. long, 5 ft. high, and nearly 9 in. thick; they were curved, so as to represent a portion of a turret 10 ft. 9 in. inside radius, see Fig. 1, Pl. VII. The backing was oak with iron skin and bolts; Schneider's plate was solid steel, held up by 16 bolts; Marrel's, Cammell's, and Brown's were steel-faced; Marrel's and Cammell's being made on Wilson's patent, and Brown's on that of Ellis. Marrel's had 11 bolts, and Cammell's and Brown's 12 each. The position of the bolts is shown by white spots. The first round at each plate was fired with a Krupp's 5·9-in. steel shell, with a striking velocity of about 1742·2 ft.; weight, 112·44 lbs.; and striking energy of 2364 foot-tons. Estimating the plates at about 5¼ tons weight, this would amount to about 450 foot-tons per ton of plate. The second round at each plate consisted of a Krupp steel 10-in. shell, weighing 402 lbs., with a striking velocity of 1410·8 ft., and consequently a total energy of 5551 foot-tons, or nearly 1041 foot-tons per ton of plate.

The effect of the first round on all the plates was more considerable than might have been expected. This is true of the whole of the plates, and as it cannot be supposed that Schneider, Cammell, and Brown, have all deteriorated in their manufacture, it must be attributed to the fact that Krupp's steel shells are better than the English or Italian chilled iron projectiles. Schneider's plate only is shown after the first round, Fig. 2, Pl. VII.

The second round tested the plate much more severely, being 1041 foot-tons per ton of plate, instead of 450 only. The effects are proportionately great. The shot made an absolute breach or hole through the steel-faced plates. They yielded, in a measure, locally. On the other hand, half of Schneider's plate was bodily carried away (*vide* Fig. 3). It is, however, to be noticed that the flank target is a little less strong and less well supported at its outward end. Figs. 4, 5, and 6 show Marrel's, Cammell's, and Brown's plates after two blows.

The third round at Cammell's broke it up, being another round with the 10-in. gun. The third round at Marrel's and Brown's consequently was fired with the 5·9-in., with a chilled iron projectile. (See Figs. 7 and 8.)

On the whole, the compound plates must be said to have held their

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AMAGER (COPENHAGEN) COMPETITION, 1884.

FIG. 2. SCHNEIDER STEEL. 1ST. ROUND.

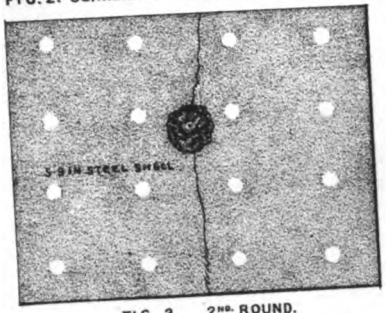
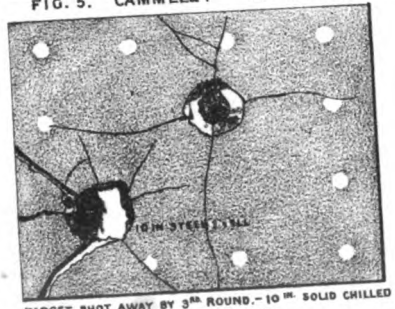


FIG. 3. 2ND. ROUND.

NO 3RD. ROUND WAS FIRED AT SCHNEIDER'S PLATE.

FIG. 5. CAMMELL. 2ND. ROUND.



TARGET SHOT AWAY BY 3RD. ROUND.—10 IN. SOLID CHILLED IRON PROJECTILE.

FIG. 4. MARREL. 2ND. ROUND.

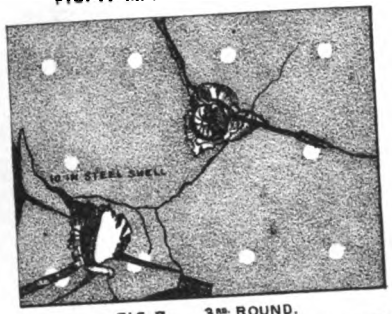


FIG. 7. 3RD. ROUND.

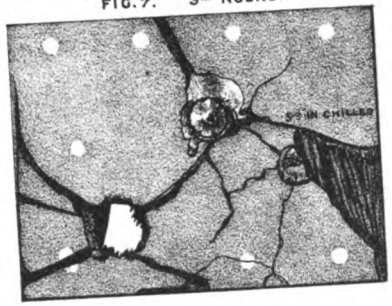


FIG. 6. BROWN. 2ND. ROUND.

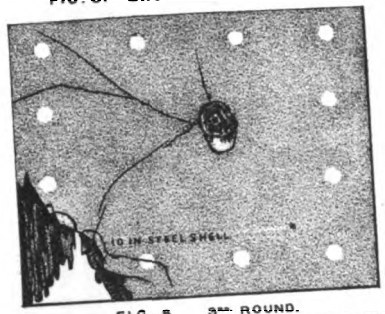


FIG. 8. 3RD. ROUND.

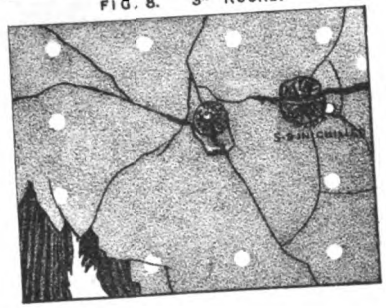
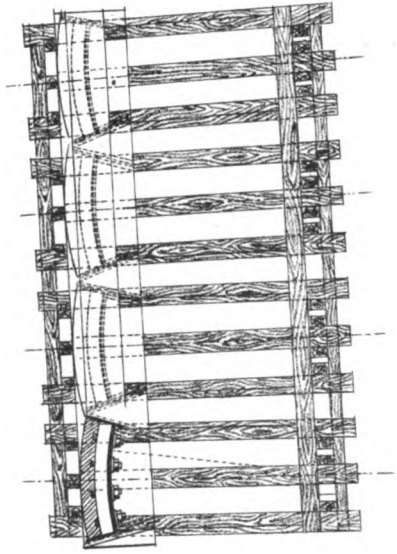


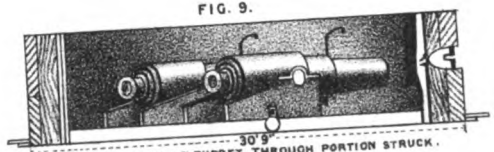
FIG. 1.

PLAN.



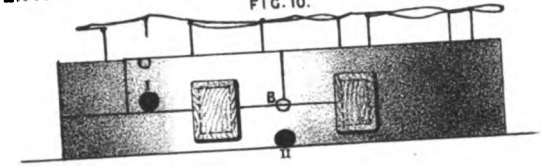
GLATTON TURRET EXPERIMENT.

FIG. 9.



VERTICAL SECTION OF TURRET THROUGH PORTION STRUCK.

FIG. 10.



PL. VII.

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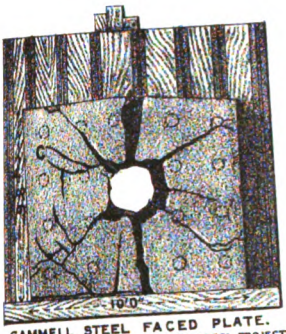
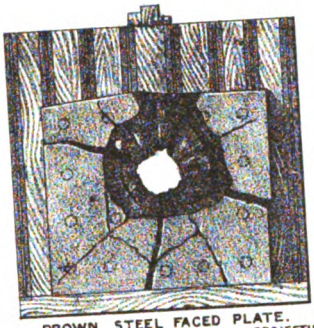
SPEZIA COMPETITION, 1884.

FIG. 1.



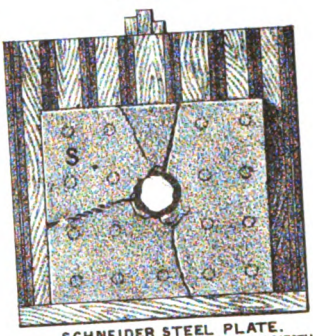
CAMMELL STEEL FACED PLATE.
AFTER 1 BLOW FROM 100 TON GUN STEEL PROJECTILE.

FIG. 2.



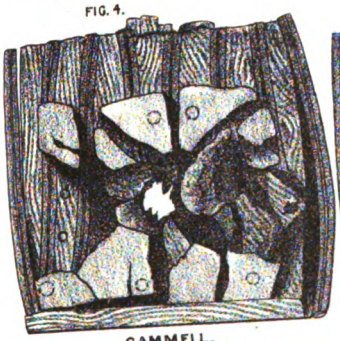
BROWN STEEL FACED PLATE.
AFTER 1 BLOW FROM 100 TON GUN STEEL PROJECTILE.

FIG. 3



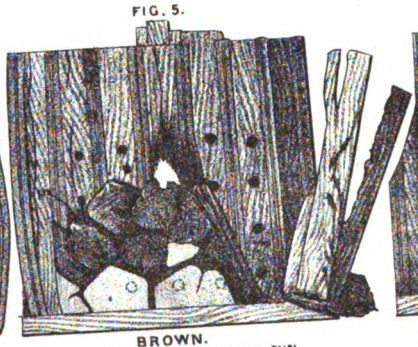
SCHNEIDER STEEL PLATE.
AFTER 1 BLOW FROM 100 TON GUN STEEL PROJECTILE.

FIG. 4.



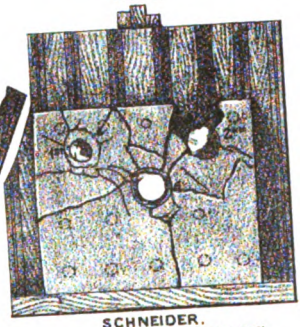
CAMMELL.
AFTER 1 ROUND FROM 100 TON GUN.
" 2 ROUNDS " 10 IN. "

FIG. 5.



BROWN.
AFTER 1 ROUND FROM 100 TON GUN.
" 2 ROUNDS " 10 IN. "

FIG. 6.



SCHNEIDER.
AFTER 1 ROUND FROM 100 TON GUN.
" 2 ROUNDS " 10 IN. "

FIG. 9.
ELEVATION OF TARGET AND BACKING.

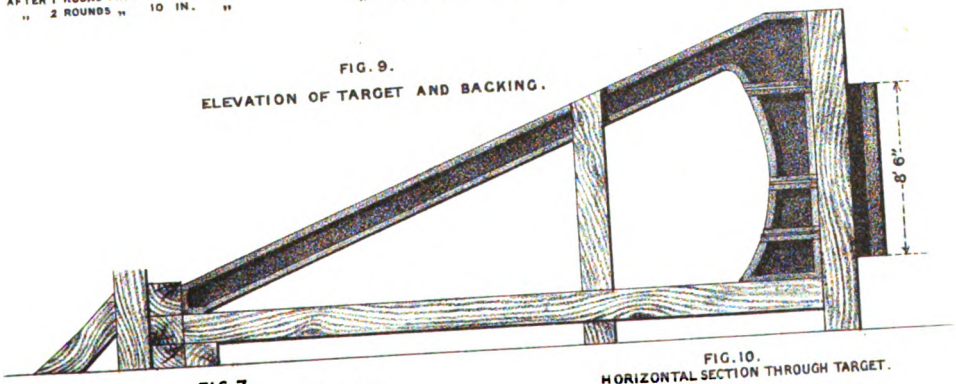


FIG. 7.
SCHNEIDER PLATE AFTER RECEIVING 1 BLOW FROM 100 TON GUN PROJECTILE & 4 BLOWS FROM 10 IN. GUN.

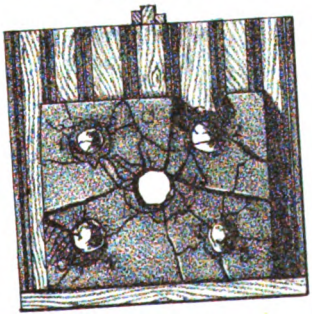
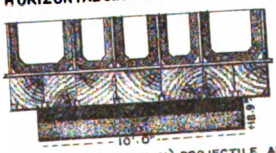


FIG. 10.
HORIZONTAL SECTION THROUGH TARGET.



SKETCH OF 43 C.M (16.9 IN.) PROJECTILE AFTER PERFORATING THE 48 C.M (18.9 IN.) STEEL PLATE SCHNEIDER.

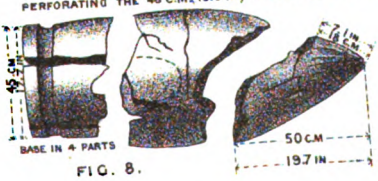


FIG. 8.

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own. Brown's and Cammell's appear to have held together better than Marrel's. The tests were not particularly suited to exhibit the powers of the plates, but may perhaps have answered the particular object of the Danish Government better than something which was more truly matched to the powers of the plate. To exhibit the actual powers of the plates on service, the backing should correspond as closely as possible to the iron or steel structure of a ship, or to the wall of a fort. As armour becomes harder, and as the blow is transmitted more through its mass, the strength of the supporting structure is called more into play.

Spezia Plate Competition, 1884.

In October, 1884, another competitive trial took place between Cammell and Brown's steel-faced plates and Schneider's solid steel. The plates measured 10 ft. by 8 ft. 6 in. by 18·9 in. (3050 mm. by 2600 mm. by 480 mm.). They were mounted on frame and backing shown in Figs. 9 and 10, Pl. VIII. One round to be fired at the centre of each plate from the 100-ton B. L. Armstrong gun, with a projectile weighing 1841 lbs. (835 Kg.), with a striking velocity of 1864 ft. (568 m.) per second, making a blow 44,340 foot-tons or 8337 foot-tons per inch circumference, implying a calculated perforation of 30·27 in. of iron, and taking the target's weight as 29 tons, an amount of energy of 1529 foot-tons per ton of plate. As the greatest amount of energy per ton of plate in the previous Spezia trials was 1046 foot-tons, while the calculated perforation through iron was 25·2 in., it may be seen that this test was very severe indeed; in fact, the plates were enormously outmatched on any standard of estimation. The effects are shown on the Cammell, Brown, and Schneider plates respectively, in Figs. 1, 2, and 3, Pl. VIII. The steel-faced plates obviously suffered much more than the steel one, but there appeared distinct reason to think that they had done more towards stopping the projectile than the Schneider plate, inasmuch as the shot went through the latter in a much more complete condition (*vide* Fig. 8).

The plates were next subjected to the fire of the 10-in. gun, with a striking velocity of about 2000 ft., with the following results, on November 5th, 6th, and 7th:—

Brown's plate, penetration, first round, 12·6 in. (320 mm.), a great part of plate was detached. Second round, the plate was demolished to the extent shown in Fig. 5. About three-fourths of the plate being now stripped off, further firing was impossible.

Schneider's plate then received two blows, producing cracks and fracture to the extent shown in Fig. 6, which is given for the sake of comparison with the steel-faced plates. Two more rounds were fired

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with the 10-in. gun, the plate at the conclusion of the programme being in the condition shown in Fig. 7.

Cammell's plate was then attacked, broken pieces of plate being thrown off to an amount estimated at nearly 5 tons (5000 Kg.) by the first round, and the plate being brought to the condition shown in Fig. 4, in the second round with the 10-in. gun, a condition which made further firing useless. The Schneider shot, therefore, on this occasion, won a remarkable victory. Few would sacrifice the power of holding together, shown by the steel, for the sake of a little more hardness, especially as both plates are hard enough to make it impossible for any live shell to perforate them intact, and carry fire into the interior. It may be seen then that Schneider's steel has repeatedly beaten compound armour on this scale. All compound armour victories have been with thinner plates. Thinner compound plates have exhibited extraordinary powers when well backed, and no doubt in all cases their hard surface would tell in their favour under oblique fire.

Cadiz Armstrong Plate Experiments.

In December, 1884, at Cadiz, an Armstrong 12-in. gun fired three chilled iron projectiles, the lightest weighing 689 lbs., and having a striking velocity of 1440 ft. All three passed entirely through a target (shown in Fig. 9, Pl. I.) consisting of four plates, each 3·94 in. (10 c.m.) thick, 15¾ in. in all, backed by 25 in. of wood; the projectile above mentioned, entered about 10 ft. into a sand butt behind the target. The above projectiles might be expected to perforate the target in question, but the fact that they were unbroken deserves notice especially, and argues excellence in quality.

Plate Experiments 1885.

Early in the summer of 1885, a proof trial of Schneider's steel plates took place at Spezia with results of a less satisfactory character than those obtained in the 1884 competition. Such results have naturally attracted attention in England, though never published, any evidence of uncertainty in quality of steel plates being important.

At Shoeburyness, during 1885, experiments took place with plates and structure proposed for the Admiral class. The result of trials can hardly be published in detail, but it may be said generally that the importance of supporting steel-faced plates well, was again shown. A given weight of metal in the form of 18 in. of armour and supporting structure resisted the impact of heavy projectiles from the 80-ton gun much less well than in the form of 16 in. of armour, with the weight of the 2 in. of armour judiciously distributed in the supporting structure. Fourteen-inch plates and 12-in. and 6-in. plates sandwiched, were also tried with inferior results. A steel-faced plate 16 in. thick bound round with steel wire or riband and backed with

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granite, on a proposal made by Major English, R.E., was fired at in October, 1885, by the 43-ton B.L. gun. This was knocked to pieces, and the fragments were thrown about. Such an experiment is hardly likely to be repeated. The steel wire is very costly, and it has been objected that theoretically it could only be employed to full advantage where it could be wound on a cylindrical bed—such as could hardly be applied to armour plates.

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CHAPTER II.

Armoured Structures.

Forts.

British Coast Armour.

General (then Colonel) Inglis, R.E., read a very valuable paper on Armoured Defences at the Royal Artillery Institution, Woolwich, in April, 1880. Since that date much progress has been made. With the adoption of breech-loading guns, has naturally come in the idea of inclined armour which could hardly be employed with muzzle loaders, because in serving them, plenty of head room is required just inside the port. The specimens given in General Inglis' paper are good representative examples of English coast forts, and will probably long be so. For their date they were sufficently strong, and special provision is made for adding to their thickness. A few examples are therefore here given.

The armoured structures take four forms: (1) *Shields built in masonry.* (2) *Shields in masonry, with guns on turn-tables.* (3) *Iron batteries.* (4) *Turret.*

Fig. 1 gives a section of Picklecombe, and a rather weak portion of *Garrison Point,* Sheerness. This is a specimen of two-tier shield fixed in masonry. At *Garrison Point,* Sheerness, the 38-ton guns have three 10-in. plates in front of them, instead of three 5-in. plates here depicted. Speaking generally, the shields are built into masonry, as follows:—A strong frame of $\frac{3}{4}$-in. plate, and 6 in. by 6 in. angle irons, is constructed in the masonry, being built in, and attached by bolts, dove-tailed pieces, &c. On this is built the armour, generally on the plate-upon-plate system. In the Figure is shown the method of lifting a plate to be attached, as indicated. The drawing generally explains itself. The plate is hoisted up to the position shown in Fig. 1, Pl. IX., and then run in by means of a traveller, A, worked by a screw with handle at B. Fig. 2 shows a specimen of turn-table battery (Class 2), such as that at *St. Helen's Fort,* Portsmouth, Malta and Gibraltar. Each gun has two ports, and moves to either one by means of the turn-table. Here, again, strong as the structure is made by intermediate layers at the ports, and heavy, iron-cased concrete supports between the ports, a compara-

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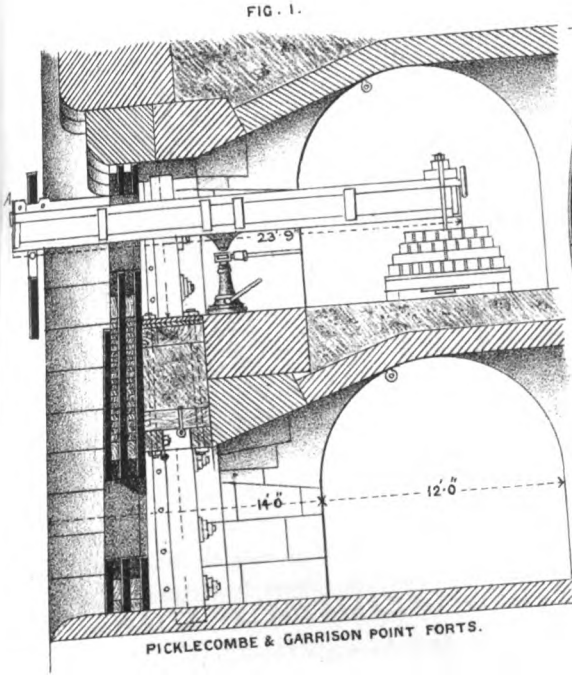
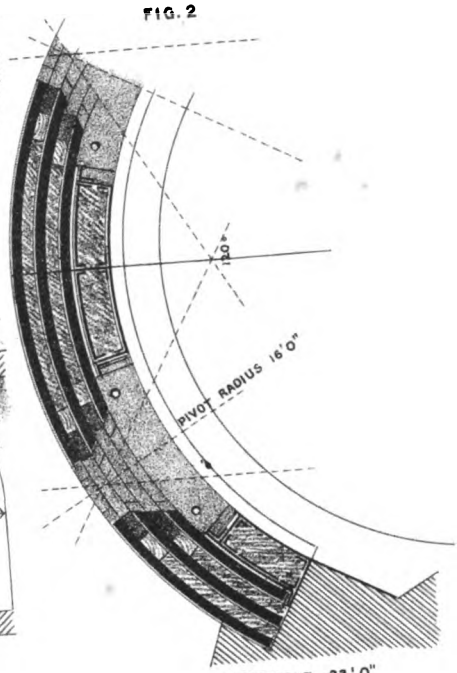
BRITISH ARMOURED FORTS (INGLIS).

FIG. 1.



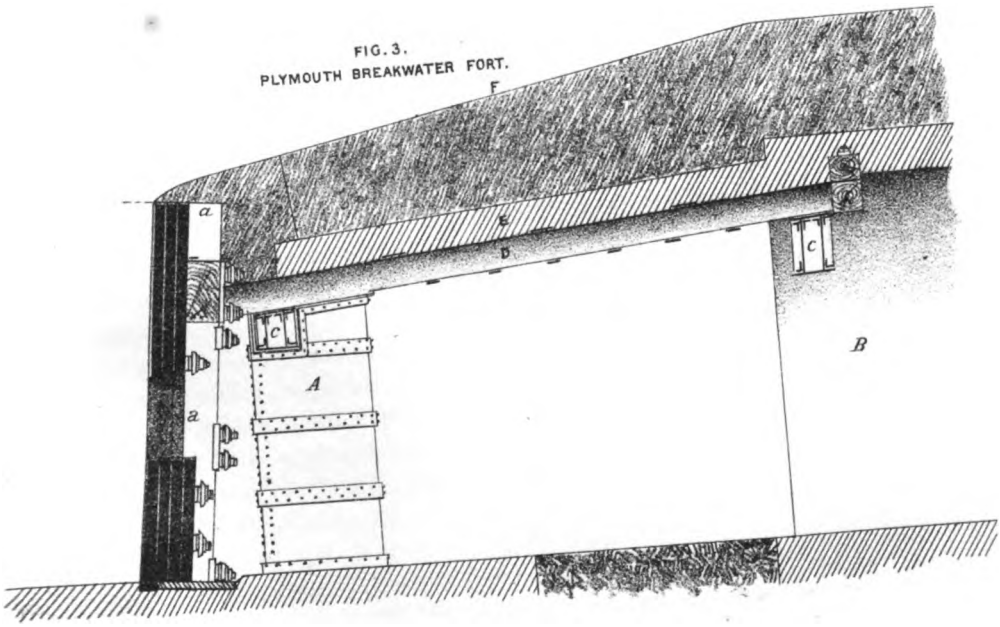
PICKLECOMBE & GARRISON POINT FORTS.

FIG. 2



TURNTABLE. 23' 0"

FIG. 3.
PLYMOUTH BREAKWATER FORT.



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tively weak example is shown—three 6-in. or two 9-in. plates being used in some places.

Plymouth Breakwater Fort may be taken as the first example of battery, with walls composed wholly of iron. It is oval in form, 144 ft. long and 114 ft. broad, and stands on a mass of masonry on a rocky bed. The floor is about 16 ft. above high-water mark. It was constructed to mount fourteen 38-ton guns and four 18-ton guns firing through small ports, 21 ft. 9 in. from centre to centre. The iron-work was commenced in 1867 and finished in 1870. There are four thicknesses of 5-in. plates about the port, and three supported by massive armour bars on edge elsewhere (*vide* Fig. 3, Pl. IX.). The piers are separate from the armoured wall. The roof is of the usual girder construction, and bombproof throughout.

There is to this, and to all the other sea forts, an entrance port into which, in preparing for action, a massive armoured shield on wheels is run, and over the entrance is a very strong cantilever beam for hoisting the guns and other heavy weights from vessels into the battery and *vice versa*, by means of heavy hoisting gear placed on the roof. The general principles of English armoured structures are better illustrated in some other forts.

The two great circular forts at Spithead, "Horsesand" and "No Man's Land," are good specimens of iron batteries (termed "*Class* 3" above).

Their foundations were laid 2 or 3 fathoms below low-water, and occupy circles of about 230 ft. in diameter. The two-tier circular iron battery commences at a level of 16 ft. above high-water. The pieces were originally intended to be 38-ton guns below and 18-ton guns above.

The two forts are almost identical (shown in section in Fig. 4, Pl. X.). They are circular to a radius of 100 ft., and the gun ports are 24 or 26 ft. apart. The inner structure or "skeleton" consists of the following parts: First, a circular baseplate 2 in. thick and about 3 in. wide, sunk into masonry, and going completely round the fort. It is slotted to take the feet of upright armour bars, which back the armour plates in front of the guns. Next, come strong pier casings made of $\frac{3}{4}$-in. plate filled with concrete. In these are set solid bars carrying part of the load above. Then comes another complete 3-in. iron ring, through which the upright bars pass, and on this rest the radial girders of the upper floor, their rear ends being carried by box girders on masonry piers. Between the radial girders are arch plates completing the floor. The front ends of the floor girders are secured to a continuous curved plate standing on edge. It is particularly to

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be observed that no part of the floor structure is fastened to the 3-in. circular plate of the skeleton. This is intended, in order, that should the front armoured wall be heavily battered, the surfaces should slide and reduce the risk of the racers of the upper guns being thrown out of position. The skeleton at the junction of the upper and lower piers is especially made strong, so as to avoid anything like a rickety joint. The armour bars are held at the top by another continuous ring. The pier casings are filled with Portland cement. The safe load of the upper gun floor and of the roof is equal to half a ton on every square foot.

The armoured wall is in three thicknesses. The inner ring is 5 in. thick, with 1 in. of wood and Portland cement between it and the skeleton. It consists of two tiers of plates and two rings of armour bars, and is bolted to inner structure and piers. The port frames are 2¼ in. thick. The plates of the middle thickness are on end, and are 22 ft. 6 in. long, reaching from granite base to roof. The plates containing ports are 7 in. thick, and the rest 5 in. thick. The outer thickness is 5 in., and the plates are in two tiers about 11 ft. each. They are bolted to the middle, and the middle to the inner plates. The intervals between the layers are filled with concrete, except near the ports where wood is used. The total weight of iron in each fort is about 6214 tons. There is provision made for adding to the iron plates and masonry, and heavier guns can be used. Each fort is intended to take five turrets on the top.

Class 4, *Turret*, is illustrated by the Dover Admiralty pier turret, carrying two 80-ton guns. This is a remarkable design (*vide* Fig. 5, Pl. X). The foundations are laid 7 fathoms below low-water mark. The entire structure is 95 ft. high, bringing the guns 33 ft. above high-water mark. The turret consists of a live ring and rollers of steel running on a path of steel laid on a massive cylinder of masonry. The moving framework weighs 240 tons, the armour 460 tons, and the total running weight, including guns, carriages, slides, &c., 895 tons, bringing on each of the 28 rollers, 32 tons on an average. The entire diameter of the turret is 37 ft., the interior 32 ft. The height of the gun chamber, 8 ft. 8 in., and of the turret armour, 9 ft. There is a massive central casting holding to the masonry, and a thick hammered steel cylinder inside this surrounds the wrought-iron built-up cylinder, forming the centre of the turret framework. Portions of the roof are removed to get the guns in and out. Provision is also made for the escape of smoke. The glacis is plated with 5- and 3-in. plates. The guns are depressed and loaded under the glacis. The chief characteristic to be noticed as belonging to the

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BRITISH ARMOURED FORTS (INGLIS).

FIG. 4.
HORSE SAND AND NO MAN'S LAND FORTS.

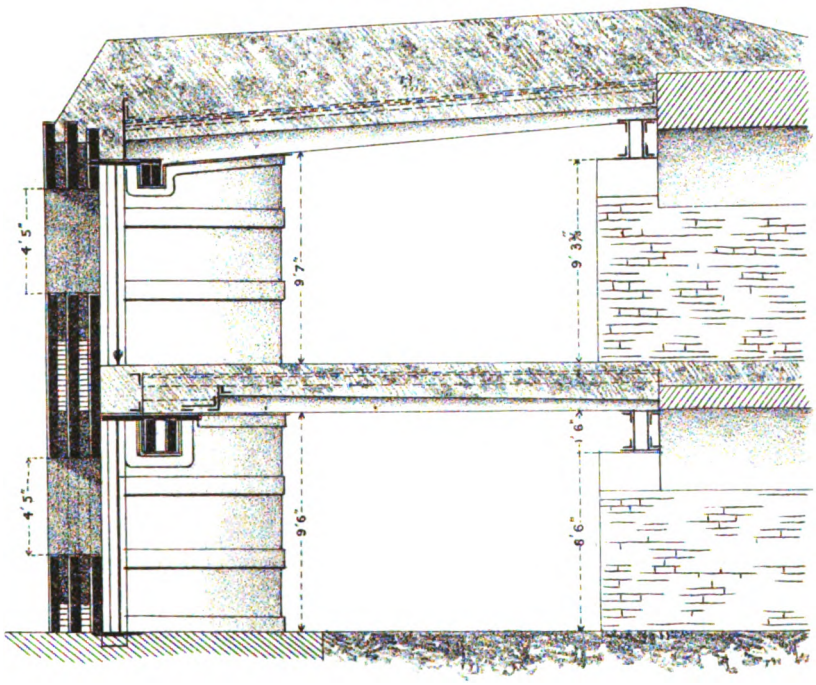
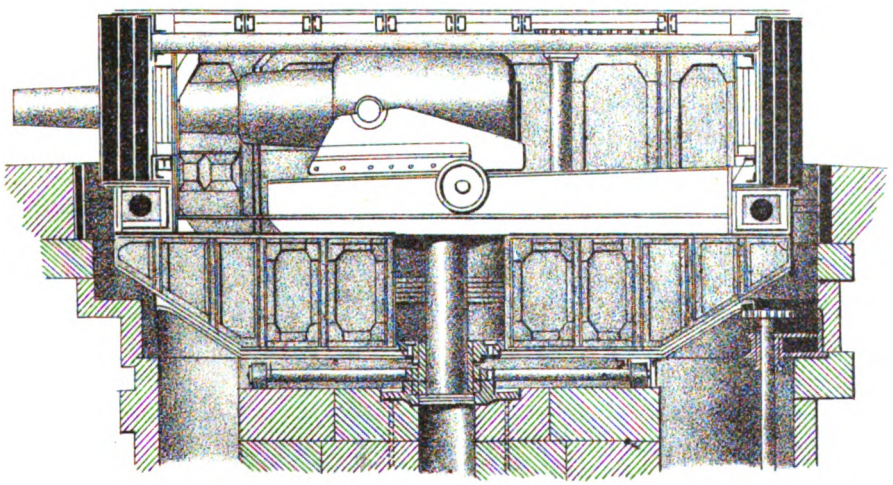


FIG. 5.
TURRET AT THE ADMIRALTY PIER, DOVER.



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whole of the English engineer coast fortifications, is the provision for constant changes and additions. To such a length is this carried, that in some cases, bolt holes with plugs and nuts are provided for the immediate addition of plates on the outside. It may be seen that plate-upon-plate armour especially lends itself to such alterations.

Bucharest Turret Competition, 1886.

In any great siege undertaken by British troops, the Royal Navy would no doubt take part. Consequently, the trial of turrets at Bucharest on this account could hardly be passed over without notice. It has, however, a wider field of interest as illustrative of the behaviour of turret armour of the two types specially characteristic of England under accurate and prolonged fire from medium guns.

Schumann Grüson Turret.

The rival turrets may be briefly described as follows:—The Schumann-Grüson cupola is for two 15-cm. (5·9-in.) guns. The form is shown in Fig. 2, Pl. XI. It offers a very small mark to horizontal fire, but the diameter has to be large, the interior diameter being 6 metres, or 19·7 ft., and it is the more open to attack by high angle fire. It is intended to resist the fire of the 27-cm. (10·3-in.) mortar. The dome curve has a radius of 5 metres (16·4 ft.), and it is 20 cm. (7·87 in.) thick. It rests on a pivot and runs on rollers on strong springs round under the circumference on a circle (*r* in figure). The port, passing through a very oblique wall, is, consequently, very oval, and the curve is modified, and the gun is fitted with a spherical collar. The port plate is of wrought iron. The gun pivots in the vertical plane about the spherical collar. To accomplish this, its breech is made to move in arc-shaped guides (*h* in Fig. 2). Counter-weights are used (*vide* Fig. 2) to balance the gun, which is thus hung and clamped at any required elevation. As its recoil is checked the shock of discharge is transmitted into the turret, and as each gun is a short distance on one side of the axis of the turret, a couple is formed by which the turret is caused to revolve slightly by the shock of discharge of either piece. A gun can be taken out in thirty minutes and put back again in forty-five minutes. The cupola performs an entire revolution in thirty seconds. Elevation is given to the gun by means of an endless screw. Three means are provided for laying the pieces:—(1) A tangent sight in the top of the cupola between the two guns viewed by putting the head through a manhole—shown at A in Figs. 2 and 5. (2) A tube pierced in the roof of the cupola in the opposite direction to the ports (*vide* B in Figs. 2 and 5) by which the desired direction can be obtained while the ports are turned away from the enemy. (3) For short distances it is possible to lay the gun by looking through the bore. The *avant cuirass,* or

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glacis shield, is made of cast iron protected by a mass of cement (*vide* Fig. 2) covered further by sand.

Mougin Turret.

Fig. 1, Pl. XI., shows the French turret. It is made by the establishment of St. Chamond, on the design of Major Mougin. The general principle of the structure is apparent. The turret consists of a thick walled cylinder 4·8 metres (15 ft. 9 in.) diameter, of three layers of wrought iron 45 cm. (17·7 in.) thick in all. It is made additionally strong by deep plates beneath the cheeks of the carriage, which are brought down to a centre piston A, on which the whole turret revolves. There are rollers under the iron framework beneath the armour wall, but this part is made separate from the wall in order to keep it from dislocation caused by the bending of the latter under impact of shot. The turret is moved by very simple hydraulic machinery worked by a man placed beneath, as shown in Fig. 1. The wall of the turret stands about a metre (39·37 in.) above the glacis, which offers a much greater mark for horizontal fire than the Schumann-Grüson curved dome. On the other hand, more interior space is given in proportion to the diameter, and the ports passing directly through the vertical wall weaken the plates less than if the direction were oblique.

In order to save the turret from the shock that would be felt if all recoil were stopped, a recoil arrangement with powerful hydraulic cylinders and springs is employed (Fig. 3). The gun pivots nearly on the port, which therefore is very small.

Each vertical armour plate weighs about 19 tons. The roof is in a single plate 18 cm. (7 in.) thick. The turrets were tried as to their working and the performance of their guns, and were then attacked by regular breaching fire. The French turret had been more fully perfected than the German one, and worked automatically. It was made to revolve between each fire, and the Grüson turret was for some reason called upon to perform in the same way.

The most doubtful feature in the German turret was the non-recoil arrangement. Unless the guns fire exactly together, the second one throws wide of the mark or must be relaid. Some of the chief advantages as to interior fittings, such as the open space and absence of complicated gear, and also the power to remove and replace guns quickly and easily, depend on the hanging of the guns with rigid connexion to the port. In working, the French turret had greatly the advantage.

The attack of the turrets which followed was probably the most important part of the programme. This commenced on December 26, 1885. Two Krupp 15-cm. (5·9-in.) guns were employed, also one

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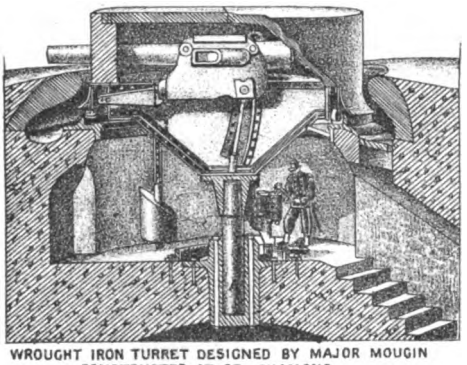
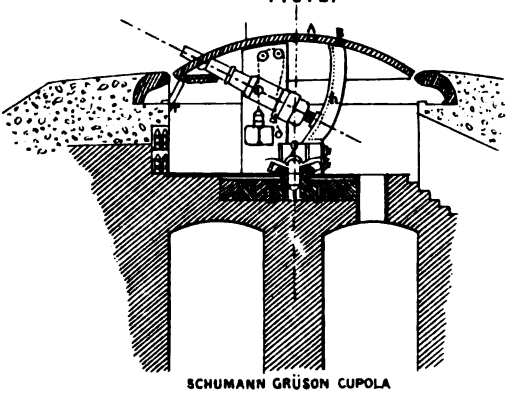
BUCHAREST COMPETITION.

FIG. 1.



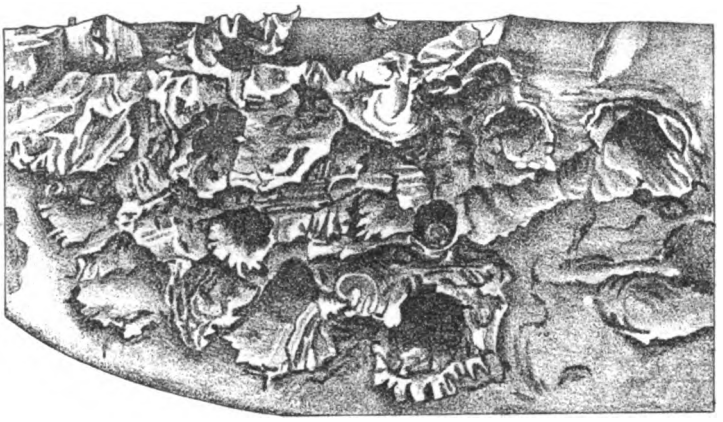
WROUGHT IRON TURRET DESIGNED BY MAJOR MOUGIN
CONSTRUCTED AT ST. CHAMOND.

FIG. 2.



SCHUMANN GRÜSON CUPOLA

FIG. 4.



THE MOUGIN TURRET.

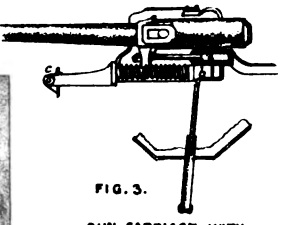
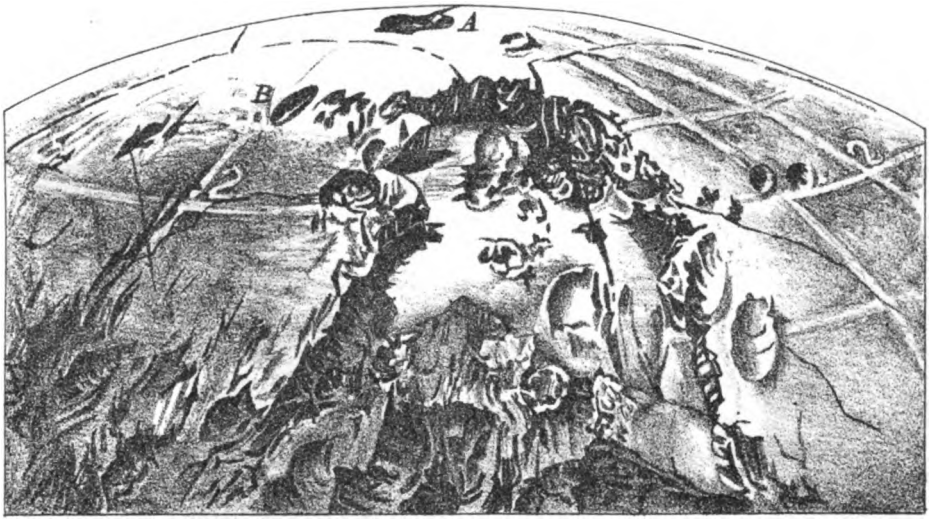


FIG. 3.

GUN CARRIAGE WITH
RECOIL BUFFER FOR MOUGIN TURRET.

FIG. 5.



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GRUSON'S CHILLED CAST IRON FORTS.

FIG. 1.

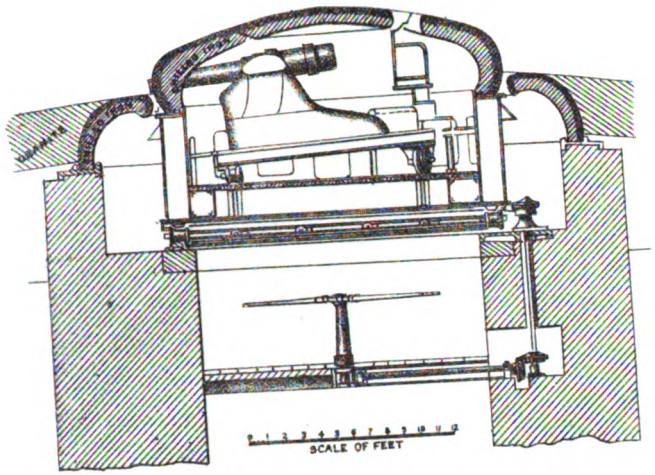


FIG. 4.

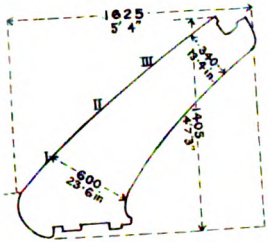
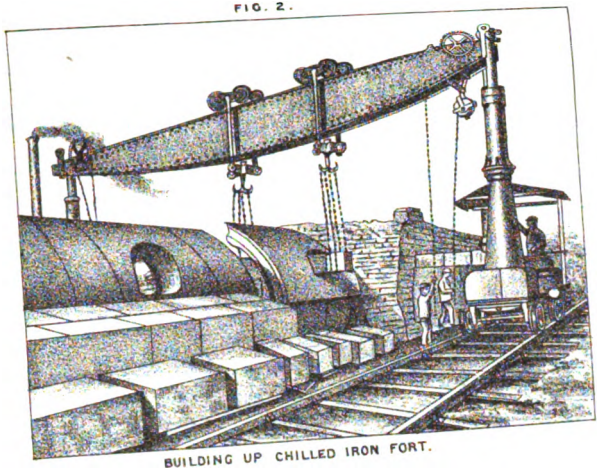
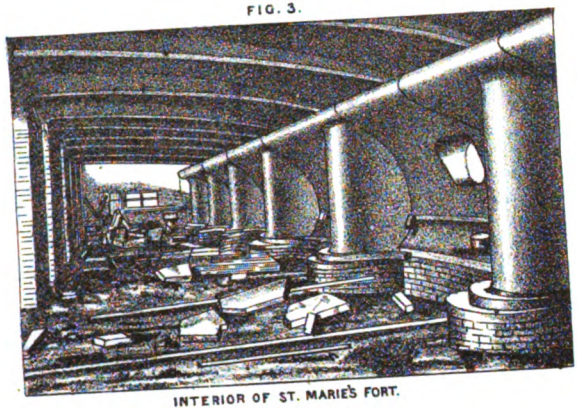


FIG. 2.



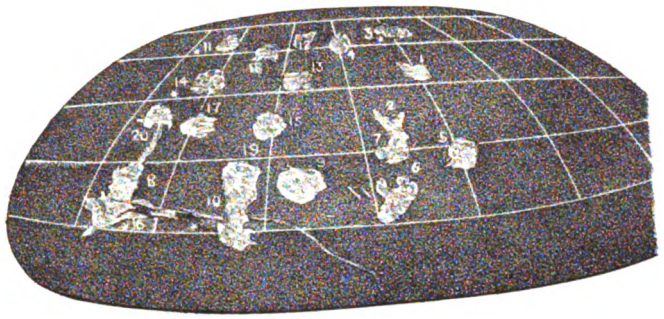
BUILDING UP CHILLED IRON FORT.

FIG. 3.



INTERIOR OF ST. MARIE'S FORT.

FIG. 5.



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De Bange gun 15·5 cm. (6·1 in.). The backs of the cupolas were first attacked at 1000 metres (1094 yds.) range, charge 9 Kg. (19·8 lbs.) steel Krupp projectiles, 38·7 Kg. (85·3 lbs.) and St. Chamond projectiles 41 Kg. (90·4 lbs.). The French turret was struck 30 times in 51 rounds, and the German 30 times and 5 ricochets in 85 rounds, it being more difficult to strike than the French. High angle fire to strike the roofs of the turrets by 21-cm. (8·26-in.) Krupp rifled mortars was unsuccessful, neither roof being struck. Had they been struck, however, no effect would have been produced.

The port plates were then attacked. The German gun is of course less exposed than the French. The Glacis plate (vorpanzer) attack followed next, and the German plate suffered much more than the French. It is rather thinner, but it was also exposed to a more severe trial.

Finally, the backs of the cupolas were again attacked; the French turret was struck 32 times out of 43 rounds, and the German 36 out of 48 rounds. The results are shown in Figs. 4 and 5. The French armour was nearly destroyed about one spot. Altogether, though the sympathy of the Romanian officers appeared to be with the French cupola, it was considered by British officers that the German armour had undoubtedly behaved very much better than the French. The principle of the German gun mounting is, however, open to grave doubt, and many of the advantages of the turret depend on it. More powerful non-recoil guns would test the turret more severely. On the other hand, recent firing at a cupola of an elementary kind at Eastbourne seems to indicate that the muzzles of guns are very liable to be struck in systematic fire such as is to be expected in a siege. If guns are to be kept back inside cupolas as far as possible, the German turret has an advantage. Turrets with flattened domes which are both difficult to strike, and which receive the blows so obliquely that it is very difficult to perforate them, are in some shape very likely to come in. The upright plate-upon-plate armour nevertheless stood very well, and speaks well for the powers of our ship turrets which could never be exposed to the fire of breaching batteries day after day on the same spot.

Eastbourne Turret Trial.

On April 29, 1886, was commenced a trial of a turret at Eastbourne. The form was the firustrum of a cone, and the armour was steel-faced. The experiment was of a confidential character, and the structure was of an elementary kind, on which little could be said at present, with advantage.

Grüson's Chilled Iron Forts.

Several European Powers have adopted Grüson's chilled iron armour for coast forts; for example, Germany has chilled iron

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cupolas and batteries for coast and river defence, on the Lower Weser and elsewhere. Belgium, Italy and France have also adopted chilled iron for coast batteries. The advantages claimed for this material are: (1) It resists glancing fire very well, and it bears a considerable amount of fire without suffering perceptibly, the metal having the power of transmitting the blow through its mass. (2) Actual perforation is impossible. The armour must be destroyed by breaking it up, and it holds fairly together after it is cracked or split through; for, the fragments being generally very large and irregular in shape, remain in their places. (3) There is no "langridge" in the interior. (4) The metal may be varied in thickness and brought to any desired form to suit the requirements of the fort, being cast in any curved form required. (5) It is cheap, the castings being sometimes made in the locality of the fort.

Fig. 1, Pl. XII. shows the principle on which a revolving cupola is made, with the metal decreasing in thickness from wall to roof. In this case the cupola is shown as made to revolve by hand. The projectiles and cartridges are lifted from beneath. Each turret generally contains two guns. Continuous fronts are sometimes erected. The best known example is that of Fort Marie, on the Scheldt, below Antwerp. Fig. 2 shows a fort in course of construction. Portions not exceeding 50 tons in weight are cast and lifted into position by rails and travelling cranes. The portions are made with grooves in the junction surfaces, and, when in place, they are keyed together by running in a mixture of lead and zinc. Fig. 3 shows the interior of the St. Marie battery. As there are no bolts or backing of any kind there can be no langridge until the mass is broken through. The employment of breech-loading guns has favoured the introduction of curved domes, which furnish a difficult object to attack, and have strong roofs. The principal objection to chilled armour in construction, is that, while it is easily made of any desired curve, it does not lend itself to alterations or additions. To join one thickness to another would be contrary to the whole idea of the action of this armour, which, as has been said above, bears shocks by transmitting them through its mass. Steel projectiles have much greater effect on chilled armour than those of chilled iron. In fact, the material is so hard that it is impossible to penetrate it, and it must be destroyed by fracture. Hence tenacity in the attacking shot appears to be as important as hardness. A single blow can only breach it when it outmatches the shield enormously. It gradually suffers under long

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continued fire. Hence it has been adopted for coasts rather than in positions where breaching batteries might be erected to bear on it.

It has been adopted for Alpine forts and was also proposed for interior forts in France until, in 1882, experiments showed that steel projectiles had more effect than had been supposed. In 1883 and 1884 some experiments were made with steel projectiles which led to the modification of the profile employed, the curve being debased as shown in Fig. 4. Fig. 5 shows the effect of 20 rounds with Ternitz steel projectiles, weighing about 76 lbs. each, from a 5·9-in. (20-cm.) Prussian gun, with a striking velocity of nearly 1300 ft., amounting in all to about 17,725 foot-tons energy, or 1426·6 foot-tons per ton of shield on the five segments attacked out of the eight (*vide* Fig. 5, Pl. XII.). The shield weighed 19 tons 12 cwt. The advocates of Grüson's armour after this trial urged that it had now shown good powers of resistance against the best steel projectiles. This is true, but the scale of the experiment is rather small, and further trials are desirable. Five flat-headed projectiles produced much deeper indentations than the pointed shot. (For the attack of this armour: See Comparison of Wrought Iron and Chilled Iron Armour, p. 327.)

Spezia Trial of Grüson's Armour, 1886.

In April, 1886, was commenced a trial of Grüson's armour on a larger scale than had ever before been attempted. The Italian Government, having decided to erect two cupolas, each mounting two 119-ton Krupp guns, for the defence of Spezia, Herr Grüson was invited to construct them on his system, on the condition that he should make a test shield capable of bearing three blows from the projectile of the Armstrong 100-ton breech-loading gun. It was expected that the shield would be split and broken in front, but no fragments were to be detached from the interior side. The blows might be delivered on any part so long as they were not within one metre of each other. Such a test was of course extremely severe, especially carried out as it was, with forged steel projectiles supplied by Krupp—projectiles whose quality was doubtless considerably improved between the date of the agreement with Grüson and that of the trial.

This experiment must be distinguished from the Bucharest Schumann-Grüson trial, which immediately preceded it. The latter was the trial of soft armour by the breaching attack of medium guns continued for a long period. This trial is the exact opposite; it is the test of three of the most crushing blows that could be fired at the time of the experiment. It is the test of a coast fort which is built

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to withstand the attack of the most powerful iron-clad ships. Such vessels would not be likely to continue in action long enough, and also to be able to fire accurately enough, to concentrate many blows on a small area of plate. In short, the trial was a more severe test than the turret would be likely to undergo in real war for a long time to come. This trial has a special bearing on the development of the powers of projectiles. English compound armour, in spite of its hard skin, does not call for the same qualities in a projectile that appear to be needed for the best attacks of chilled iron. Our chilled iron service shot, which are of their kind excellent, have exhibited such powers against steel-faced plates that there is considerable danger of overlooking the fact that such projectiles are probably almost useless against chilled iron. Certainly no foreign chilled iron shot has been found to be of much avail against it. The shot meets with an abrupt shock directly its point touches the shield. The best steel flies into pieces, but in the act of doing so its tenacity is sufficient to enable it to deliver a great shock on the shield. A chilled iron shot has little tenacity, and it is caught at a disadvantage when resisted without the chance of getting its point any sensible distance into the plate. Hence it breaks up without delivering a blow at all proportionate to its energy. A blow that comes after fracture of shot in the form of a mass of fragments is, of course, of no use against armour. Grüson's shield is shown in section and front elevation in Figs. 1 and 2, Pl. XIII. The trial plate was fixed between two cheeks of iron, which are made large enough to obtain a good bearing on the masonry at each side, and thus to put the shield in as nearly the same condition as possible as that in which it would be placed in an actual turret. The recesses at the ends of plates are now made to fit, white metal not being necessary to key them together.

The firing took place in St. Maria Bay, in the Gulf of Spezia, where the shield was erected facing the sea. Three rounds were fired from an Armstrong 100-ton steel B.L. gun belonging to the Lepanto, which was mounted on a special raft drawn up opposite the shield at a range of 133·7 metres (438·7 ft.) The projectile in each round was a hardened forged steel Krupp shell, whose weight was made up to 1000 Kg. (2204·6 lbs.). It was 48 inches long, and had an ogival head of two diameters radius (see Figs. 7 and 8, Pl. XIV.). The charge was in each round 375 Kg. (826·7 lbs.) of Cologne prismatic cocoa powder, contained in four cartridges. The pressure in the bore was only tested in the last round when it was about 1998 atmospheres (13·11 tons per square inch). The details of each round are shown in the following Table:

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GRUSON'S TURRET FOR 2 KRUPP 119 TON GUNS.

FIG. 1. SECTION.

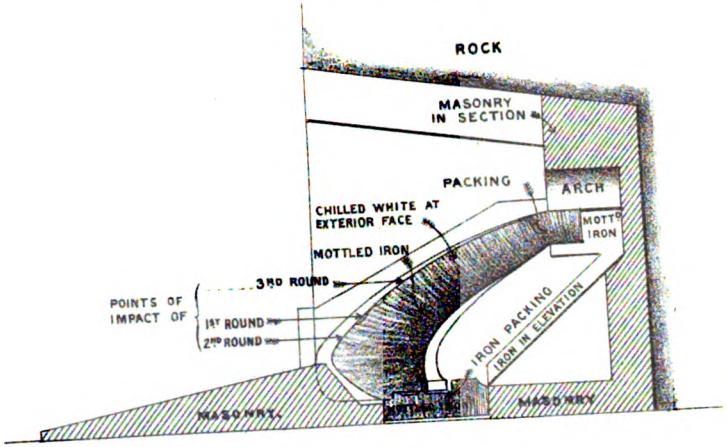


FIG. 3. PLAN.

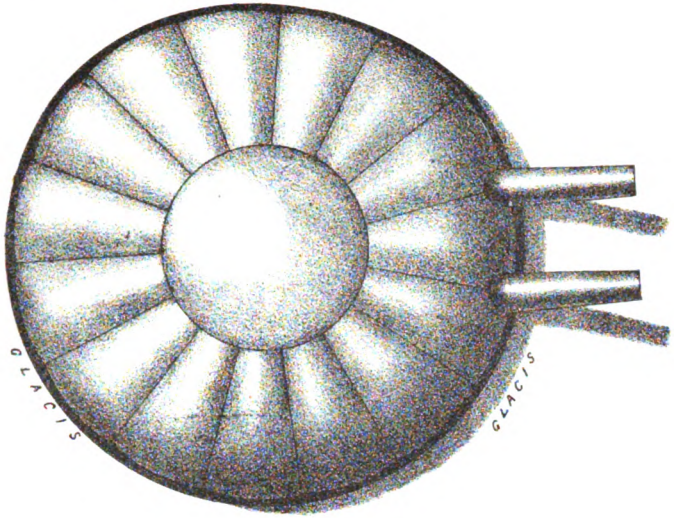


FIG. 2.
FRONT ELEVATION.

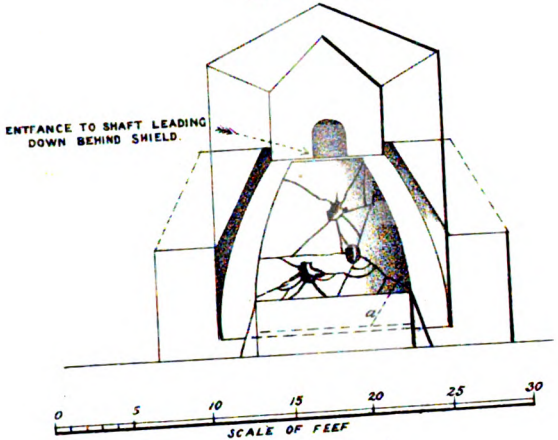
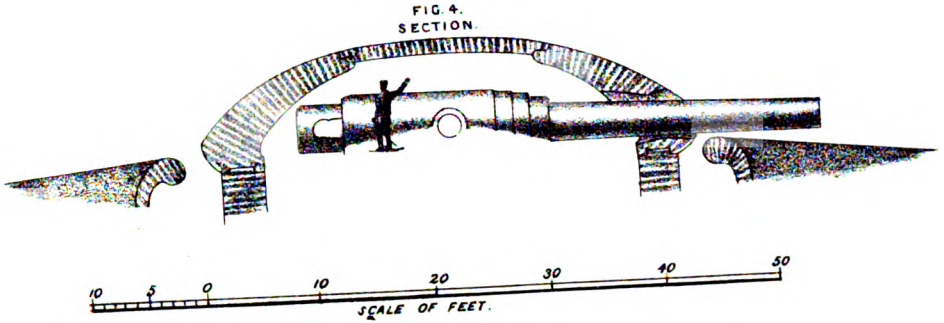


FIG. 4.
SECTION.



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Ballistic Power of 100*-ton Breech-loading Armstrong Gun Fired at Spezia on April* 20*th*, 24*th, and* 29*th*, 1886.

Number of Round	First.	Second.	Third.
Velocity at muzzle in mètres	541·2	541·9	540·1
„ „ in feet	1775·6	1777·9	1772·0
„ at 85 mètres in mètres	538·6	539·3	537·5
„ at 278·9 ft. in ft.	1767·1	1769·4	1763·5
„ at striking in mètres	537·2	537·9	536·1
„ „ in feet	1762·5	1764·8	1758·9
Energy at muzzle in mètre-tons	14,929	14,966	14,871
„ „ in foot-tons	48;207	48,326	48,019
„ at striking in metre-tons	14,709	14,747	14,651
„ „ in foot-tons	47,499	47,629	47,306
„ „ per in. cir. foot-tons . . .	892·8	896·9	888·6
Perforation in wrought iron at striking, inches .	31·2	31·2	31·1
Angle of incidence of projectile with tangent to shield	40 deg.	44 deg.	34½ deg.
Energy in foot-tons at impact per ton of shield .	548·9	550·1	546·4

The positions of the three blows and the effects produced are roughly shown in Figs. 5 and 6, Pl. XIV., which are developed diagrams of the front and back of the shield. The second blow will be seen to be the most severe. The front was broken and chipped, and the shield split through, and some parts slightly displaced; but it was thought probable that it might bear another round if necessary, and a battery behind it would have been completely protected. Three small pieces were detached from the inside. They did not fly like bolt heads, but were shaken off and dropped apparently harmlessly. On the other hand, rounds 1 and 2 were within a mètre of each other. The Italian Commission considered that the shield had proved its excellence, and Grüson was authorized to make the two turrets contemplated.

Figs. 3 and 4, Pl. XIII. herewith, give a rough plan and section—drawn from verbal description—of the complete turret. It will be seen that there are fifteen segment or sector-shaped shields, with two centre plates forming the crown. The interior diameter is 10 mètres (32·8 ft.). The periphery is not a circle, but is formed of fifteen arcs of circles, each struck with a radius of about 15 ft. or 16 ft., giving an outline suggestive of that of a pomegranate. Of the fifteen plates, twelve are similar to the shield under trial, each weighing about 87·950 Kg., or about 86·56 tons. The remaining three are lighter, being pierced by the ports; the lightest being that between the gun

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ports. The twelve unpierced plates will thus weigh about 1039 tons. The two centre or crown pieces weigh together 130,000 Kg., or 128 tons. The total weight of the armour is 1,400,000 Kg., or 1378 tons. This leaves 211 tons for the three pierced plates, two of which will be something over and the other something less than 70 tons. The entire running weight of shield is 1378 tons. It is to be worked by Elswick hydraulic machinery.

The fact that the Krupp steel projectiles from the 100-ton gun had broken up on impact against the Grüson shield, prompted the desire to fire small projectiles of known excellence, in order to test whether their large size had told injuriously on the quality of those of the 100-ton gun. At the same time it was thought desirable to compare French and German steel.

Consequently, on June 22nd, 1886, two Krupp forged steel projectiles were fired from a 15-cm. (5·9 in.) gun, and one St. Chamond steel projectile from the 100-ton B.L. gun at the same Grüson shield, of which the cracks were wedged and patched up with zinc. These projectiles all broke up. The French one struck by accident in a weak spot close to II. in Fig. 5, Pl. XIV. So far as could be judged it behaved like those of Krupp. The shield still possessed resisting power to bear a further attack.

During the summer of 1886 a series of experiments has been commenced at Shoeburyness with French forged steel projectiles. Excellent shells have been supplied from Firminy, Holtzer and St. Etienne, but it would be premature to give results in detail.

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FIG. 6.

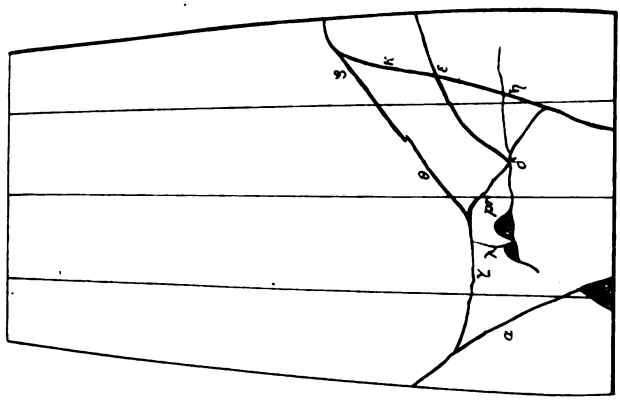


FIG. 5.

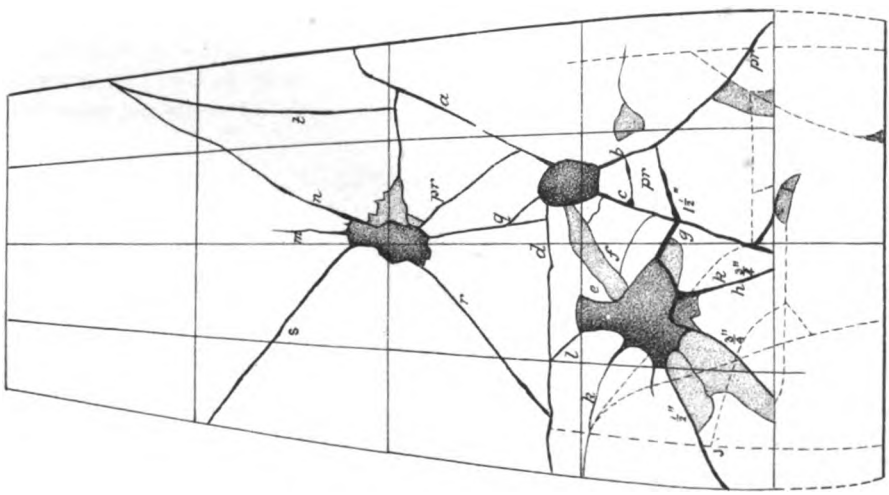


FIG. 8.

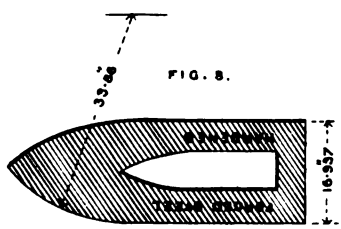
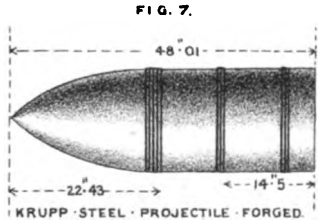


FIG. 7.



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CHAPTER III.

Attack of Armoured Structures.

Comparison of wrought iron and Grüson's armour.

It seems especially necessary to point out the great difference that exists between wrought iron and chilled iron, because they suffer in different ways, and can best be attacked by different projectiles. At the present time any foreign fleet lying off a foreign armoured fort, would furnish an example of the two kinds of armour, for the older ships would as certainly be clad in iron as the forts would be covered with Grüson's chilled iron armour. Wrought iron must be perforated. Chilled iron must be fractured. The former is effected by shot in proportion to their powers of perforation. The latter probably in proportion to their total energy. What is especially liable to mislead is the fact that guns' powers are generally estimated according to perforation. How different may be the powers of guns against soft armour like wrought iron, and hard armour like Grüson's, may be seen from the following example.

In Copenhagen, in March, 1883, a Krupp gun, 15 cm. (5·9 in.) and an old type Armstrong 9 in. gun were used together against the same target. Their respective energies per inch circumference, were 123 and 118 foot-tons, so that in perforating power the Krupp gun had a slight advantage. Their total energies, however, were 5760 and 16,403 foot-tons, so that the Armstrong projectile, if fired against armour which could not be perforated (for example, against chilled iron forts), would have nearly three times the effect, having nearly three times the total energy of the Krupp projectile. Speaking generally, the new type guns would display their powers best against ships, for though total energy and racking power have been increased in these guns, it has not been at all in proportion to the increase in power of perforation, because the small calibre assists perforation, but does not affect the question of total energy and total smashing blow.

Generally speaking, then, the older-fashioned guns might do better against forts than might be expected, while any smaller new-type

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guns would only display the full powers with which they are generally credited, against ships or other structures covered with armour sufficiently soft to admit of perforation.

I.

Remarks on the Attack of Armoured and Unarmoured Structures.

Certain parts of a ship are of the most vital importance, such as her magazines and boilers, and a sufficient number of cells to keep her afloat. Some of her guns and engines may be included in the same category.

Such portions are specially protected by armour, and their attack, while it is the most decisive that can be made, if successful, calls for guns of definite power suited to the circumstances of the case. This species of attack has been termed, for the sake of distinction, *the primary attack.*

On the other hand, there exist in all vessels portions that are slightly protected or altogether unprotected by armour, and consequently subject to injury from light ordnance, and these parts have augmented in number as armour has become more and more limited in area, owing to the necessity of increasing its thickness in order to obtain greater security for the vital parts above mentioned against modern guns. Such unprotected portions will be found to include objects whose destruction, though not vital to the existence of the ship as a fighting machine, would still cause great inconvenience.

For example, the captain and the focus of all the communications to the various parts of the ship may sometimes be imperfectly protected; and though one or more alternative centres of command may and do generally exist, yet the destruction of the primary one must cause serious inconvenience.

Then again holes in a ship immediately over the water-line armour belt, especially well forward, will, under many circumstances, cause an inconveniently large quantity of water to enter, and ships may be seriously hampered by the destruction of parts of less direct importance if effected on a large scale. The employment of artillery fire with this object has been, for the sake of distinction, termed the *secondary attack*, and this forms the natural work for any pieces that cannot hope to achieve success in the *primary attack.*

In many cases in action it may be necessary to fire without the opportunity being given for careful discrimination. In some instances, however, where the enemy's ship is well known, and the firing is deliberate, it may be important both to aim systematically and to assign work to guns that they are capable of performing.

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Thus in pursuing a ship, it may be important to know whether her steering gear can be easily reached and disabled, as in the case of the Huascar, or whether, as in the case of a ship with twin screws, it may be specially well protected. Before discussing further the primary and secondary attacks, it may be mentioned that there exists another form of attack which cannot exactly be included in either, as its possibility depends wholly on circumstances. This is the attack of decks. This attack may be of the most dangerous character, and may occasionally be undertaken by comparatively insignificant pieces of ordnance, but ships only subject themselves to it under special conditions, and generally speaking knowingly.

Primary attack. For this it is as important to know the nature of an enemy's armour as to know its thickness.

Armour may be classified as *soft* or *hard*, and dealt with accordingly.

Soft armour, including wrought iron in any of its forms (except steel-faced), can hardly be broken up, and is practically uninjured by partial penetration, however often repeated. It is therefore useless to fire shot that cannot penetrate it completely, because each effective round must *perforate* (that is, completely penetrate) the armour, and work mischief independently of the action of other rounds fired.

The following *rule of thumb* admits of proof on certain assumptions, and may be found useful. **Rule of thumb.**

Take the calibre of the gun as a measure of the armour, and it will be found that no shot can perforate a plate, unless it has over 1000 ft. velocity for each calibre in the thickness. Thus an 8-in. projectile must have over 1000 ft. striking velocity to perforate an 8-in. plate. It must have over 1500 ft. velocity for a 12-in. plate, over 2000 for a 16-in. plate, and so proportionally.

For many new type guns firing projectiles heavy in proportion to their calibre, the direct perforation is very close to one calibre for every 1000 ft. striking velocity.

In *oblique fire* the perforation is found by multiplying the direct perforation into the sine of the angle made by the axis of the shot with the face of the plate, unless this angle becomes too oblique for the shot to bite, which will generally be the case below 50° or 45°, even with armour below the power of the shot.

Old-type guns and a few new guns firing projectiles of large calibre in proportion to their weight, have less penetration than that given by the above rule; while guns of the future with a calibre which is very small in proportion to their weight, may obtain greater perfora-

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tion than given by the rule of thumb if fired under very favourable conditions.

On the whole, then, it may be concluded that it is useless to fire at wrought-iron plates with less than 1000 ft. striking velocity for each calibre in the thickness of the plate attacked, further allowance being necessary with old-type guns, in oblique fire, and also some allowance for backing.

Diagrams. For immediate use in connexion with service guns, projectiles and charges, General Inglis prepared a diagram on which perforations can can be read off at a glance. If the charge differs from that specified on the diagram, the perforation for any given velocity is correctly shown, but the range at which this is marked will no longer be correct.

Colonel Maitland has a diagram which may be employed for any question of perforation of iron. It is less quickly used and less simple than that of General Inglis, but it is available for experimental and irregular conditions, it gives more information than any other, and in using it an actual process of calculation is mechanically performed, which is perhaps more perfect in theory than any other known in England.

The accompanying diagrams, Pls. XV., XVI., XVII. and XVIII., are based on a series that owe their origin to the official one prepared by Colonel Noble in 1873. Foreign ships were given by Captain Grenfell, R.N., in *Engineering*, and have been shown for some years past in the Austrian *Marine Almanack*, as well as in the *British Navy*. To give to these diagrams a definite practical character, the following course has been followed.

On the supposition that 3000 yards is the maximum range at which side armour will be systematically attacked, all projectiles perforating up to 3000 yards are shown with a clear blank hole. For every perforation effected only at shorter ranges, the limit of range is entered in or near the hole. Thus, any officer finding armour corresponding to that of his enemy with a blank hole opposite his gun on the diagram, may hope to perforate *with a direct hit* at least up to 3000 yards. Should he find a number less than 3000 yards entered, he must not expect to perforate beyond the range so entered.

The armour is wrought iron. It is only approximately representative. The types are chiefly French. The perforation includes backing and skin.

Colonel Maitland's diagram has been used for calculating loss of velocity at each range. On service each hit would have less power

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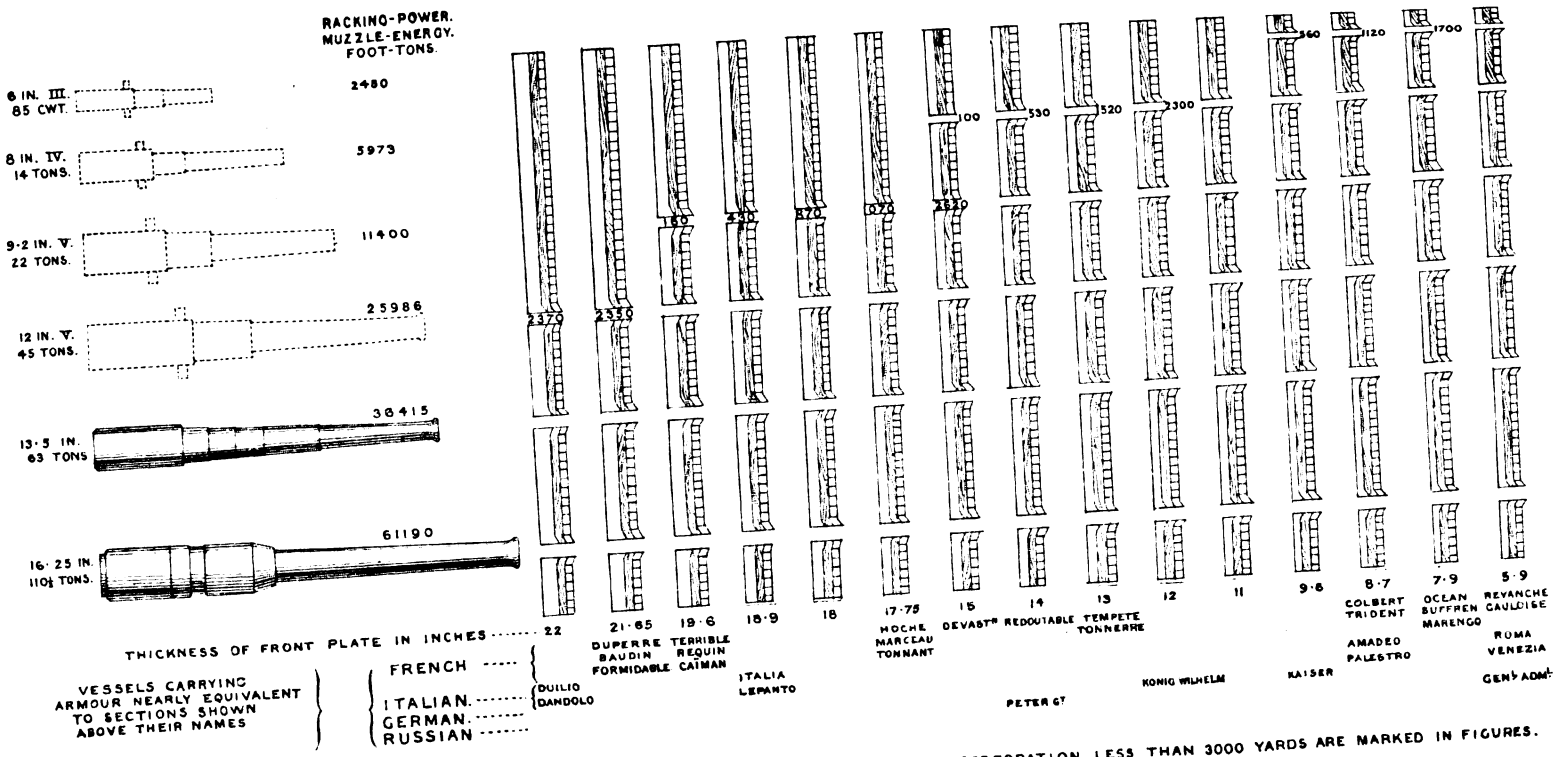
BRITISH B.L.GUNS.

PERFORATION.



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE - 20 FEET TO AN INCH. SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN. SKIN.

PL XV.

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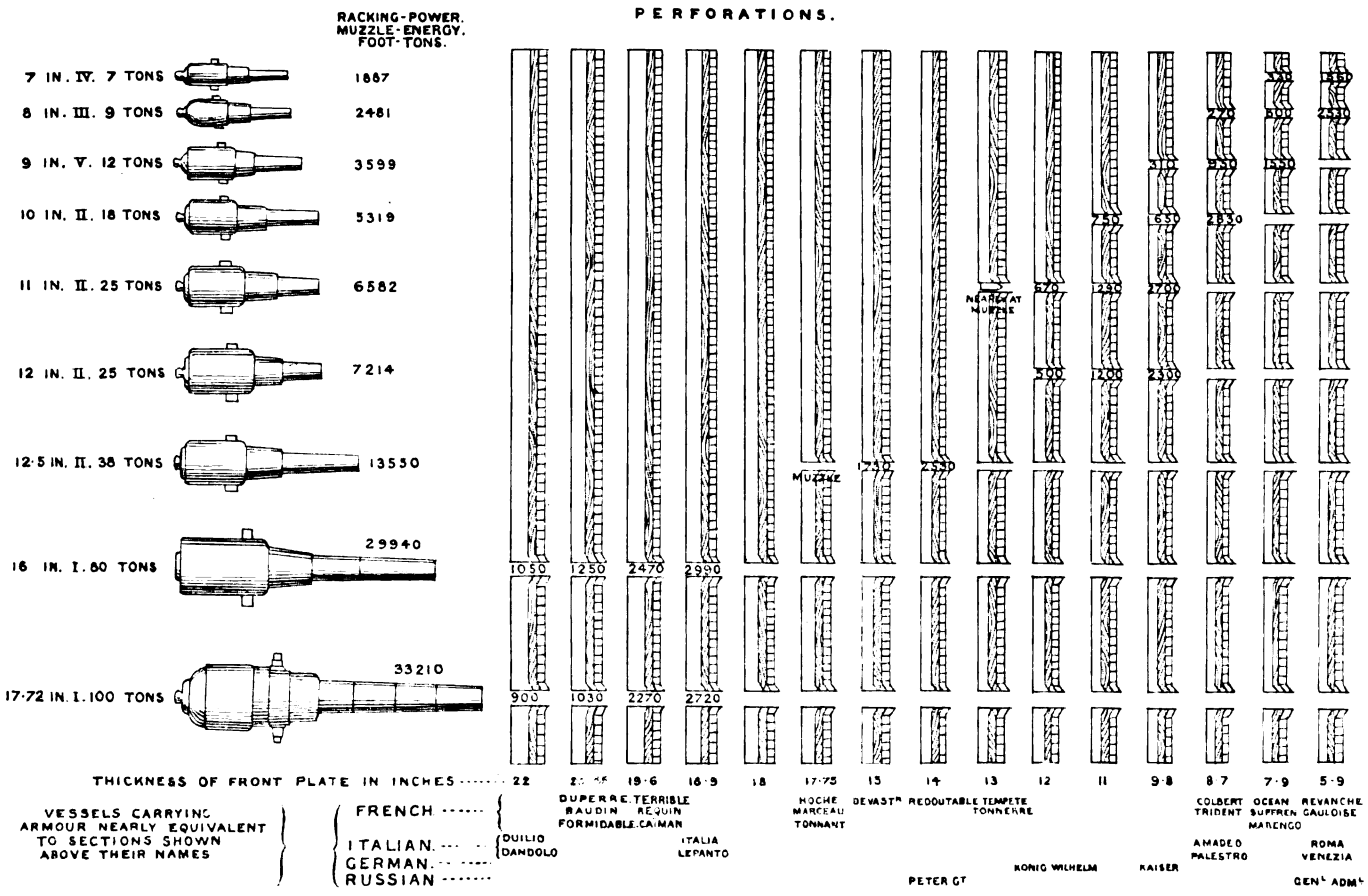
BRITISH M.L. GUNS.



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE - 20 FEET TO AN INCH. SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN. SKIN.

PL.XV

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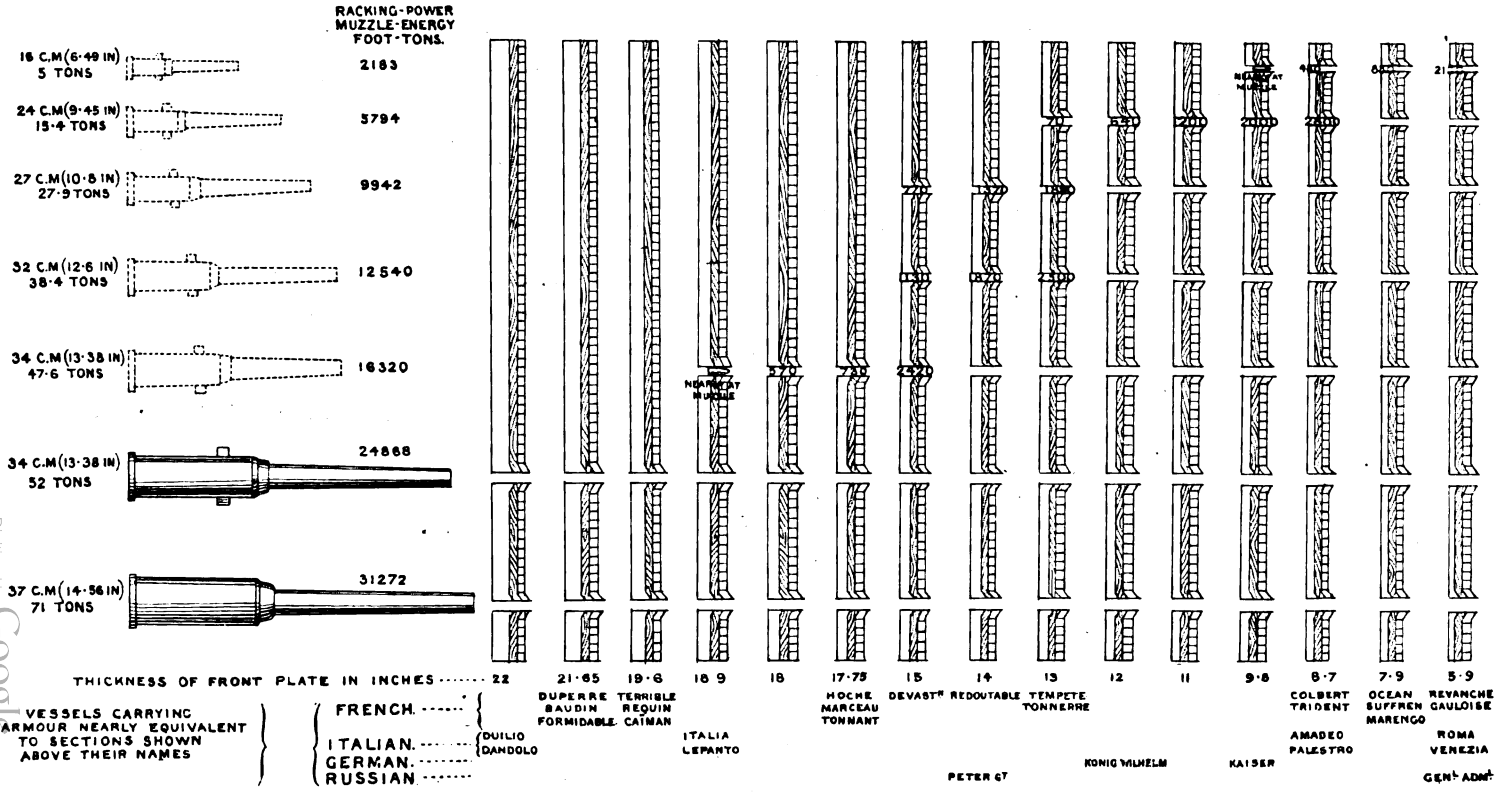
PERFORATIONS.



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE - 20 FEET TO AN INCH. SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN. SKIN.

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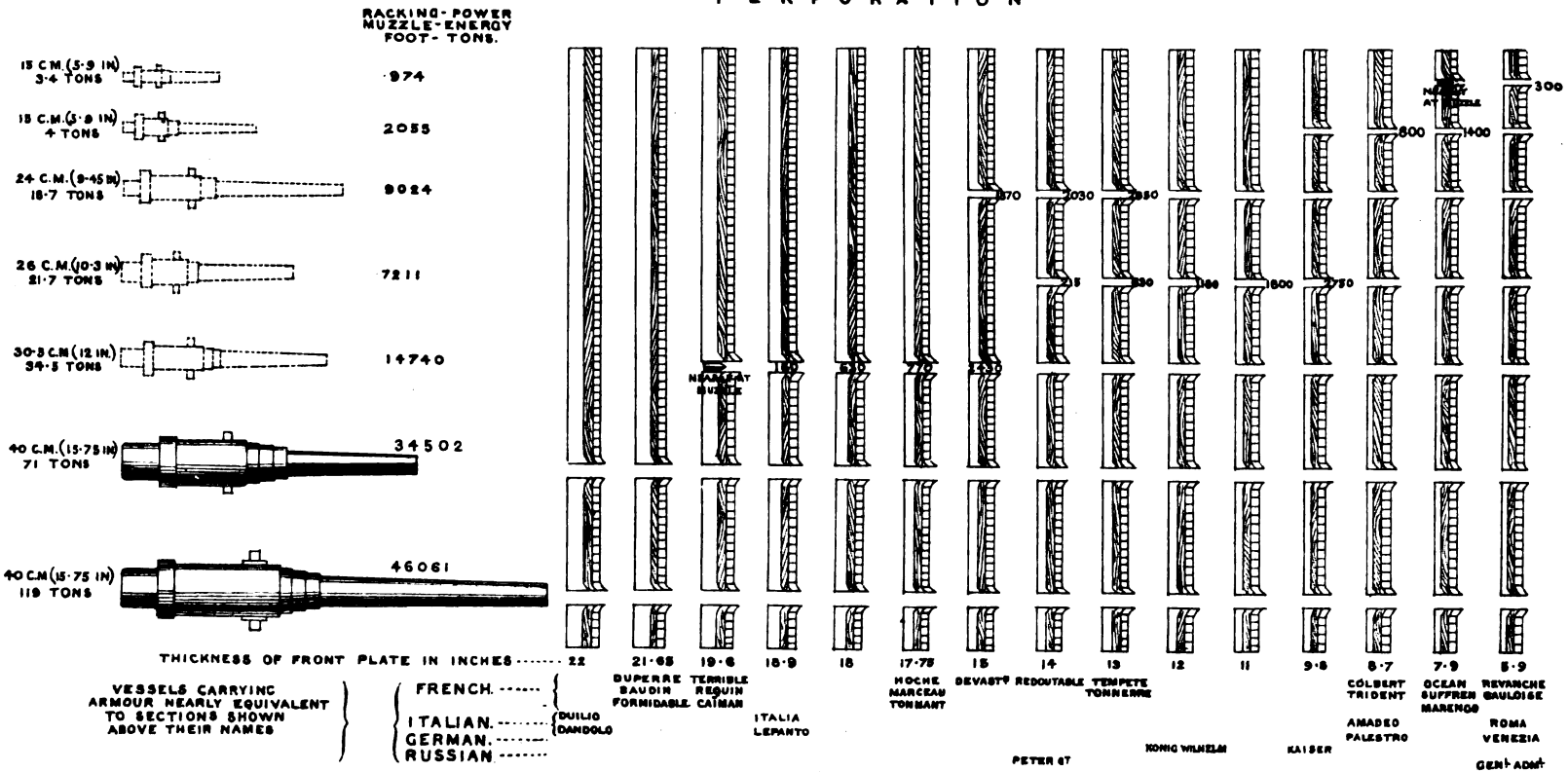
GERMAN GUNS

PERFORATION



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE - 20 FEET TO AN INCH. SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN. SKIN.

PL. XVIII

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to perforate than is indicated on the diagrams, in proportion as it strikes more obliquely.

The diagrams must be regarded as only approximate. They may however be of practical value, for an officer may be able to see at a glance that some ship's armour is *well within the power of his guns* or *quite beyond them*, and behave accordingly.

On this, *vide* Remarks on the Attack of Armour, p. 324.

All armour-clad vessels built prior to 1876, and many subsequently, are *iron*-plated. To these the above directions apply. For example, suppose 10-in. M.-L. guns to attack the French vessel Redoubtable, carrying 14-in. plates along her water-line, and 9½-in. plates on her central battery, the above rule would indicate that it would be useless to attack her water-line with less than 1400 ft. striking velocity, and her battery with less than 950 ft. Now the 10-in. 18-ton M.-L. gun has a muzzle velocity of little over 1364 ft., and even if by a special charge it were brought up to 1500 ft., it would be right for such guns, even at the shortest ranges, to attack the central battery and not the water-line, for something must be allowed for backing, probable obliquity of impact, and range. The Redoubtable, like some other French ships, has an unarmoured battery which might be attacked by any ordnance.

Hard Armour.

Hard armour, including chilled iron and the harder steel and compound plates, cannot be perforated, and must be broken up before the structure behind it can be injured materially. A single hit will seldom do more than injure the armour itself. The harder kinds of such armour will suffer more than wrought iron from the continued fire of comparatively light guns. The smashing effect of a projectile on hard armour is probably in proportion to its *total energy*, irrespective of calibre. It is difficult to apply any rule to the case of hard armour, but it is desirable as far as possible to concentrate and continue the fire about the same spot, and all guns are available for such work. Such an operation may seldom be feasible in engagements between ships.

With regard to projectiles.—Filled Palliser shells are only effective against thin armour. *Steel shells* have perforated iron and even steel plates without deformation, and steel shells containing gun cotton bursting charges have occasionally been made to pass intact through thick wrought-iron plates, but not through any harder class of armour. *Common shells* have perforated unbacked iron plates half a calibre thick, that is to say, a shell of 16-in. calibre fired from the 80-ton gun has passed through an 8-in. plate, and a 10-in. common shell through a 5-in. plate.

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Recent Order as to Palliser Shells.

It has recently been decided that no service armour-piercing projectiles shall be fired with bursting charges of "black powder." Forged steel shells require a stronger explosive to burst them. It appears to be thought that armour sufficiently thin to be successfully attacked with projectiles capable of being burst by powder would be better dealt with by common shell. This conclusion may possibly be based upon experiments with common shell and *backed* plates, of which reports have not been made public. In the engagement with the Shah the only loss incurred by the Huascar crew was caused by a 9-in. common shell from the former ship, which perforated the water-line armour somewhat abaft the midship point, where it must have been about 3½ in. thick, and supported by backing. This shell exploded destructively between decks.

Experiments at Shoeburyness, on the other hand, have shown that generally the blunt head of a common shell breaks on impact, and the projectile perforates by driving out a disc of the plate in front of it. Backing enormously interferes with this kind of perforation. There still exist a sufficient number of vessels with thin armour to make this question important. The Huascar turret armour 5½ in. thick, was perforated by two 9-in. filled Palliser shells, fired from the Cochrane or Blanco, which seem to have burst inside (*vide* p. 335). The destructive effect was very great, all the men in the turret being killed. It appears unlikely that a 9-in. common shell could perforate a 5½-in. plated turret, and a shot would surely do less damage inside.

Unarmoured parts of ships are probably most effectually attacked by common and shrapnel shells. The former act best with direct-action fuzes. The Pettman fuze has often failed to be set in action with new-type guns; also its action is apt to be too slow, so that the shells split open instead of bursting explosively. *Shrapnel* shell may be fired plugged, as the passage through thin iron breaks them up, and they make great havoc in the interior of an unarmoured ship.

Deck Attack.

Deck attack.—This is the attack of a ship's deck, either by guns firing from positions of high command or by vertical fire. A ship lying head-on is generally well protected as to her sides, but this is often the best position for the attack of her deck. Vessels are now generally constructed with armoured decks capable of resisting at 10° the fire that is a match for their side armour striking direct. Consequently, such a deck struck by prejectiles glancing along it at angles more oblique than 10° to the deck plate should be stronger than the side armour, but if, from the heel over of a ship, or from the high

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command of the attacking battery, the shot strikes the deck more directly than 10°, the ship becomes more vulnerable to deck than side attack. The best authorities have at all times laid down that batteries placed high on land attack ships to greater purpose than those on the sea-level. It may be questioned in many vessels whether projectiles would not generally explode or break in passing through an upper deck before they reach the armoured deck.

The attack of decks by approximately vertical fire is a separate question, and must not be confused with the plunging attack of gun-fire. This may be carried out by comparatively insignificant pieces of ordnance such as rifled mortars and howitzers, which can be easily and cheaply placed under cover of earthworks. Very striking results, as far as accuracy is concerned, have been obtained by the high angle fire of rifled ordnance experimentally,* but on service it could not be expected to succeed except against vessels at anchor, a position they may be compelled to take in water which is imperfectly cleared of submarine mines. Trials are necessary also to determine the effect of falling projectiles against deck plates. At Shoeburyness recent trials have been made with a 9-inch howitzer against 3-inch deck plates, which were perforated, or broken through, at 3000 yards range.

II.

Armoured Ships Under Fire. Glatton Turret Experiment.

Experiments are seldom made as to the effect of fire on complete service structures, the expense being very great, the lessons learnt having, however, a special value. For this reason it may be well to keep in view the Glatton turret experiment at Portland on July 5, 1872, made with the object of testing the liability of turrets to be distorted by blows of shot sufficiently to interfere with their revolution. The turret was struck twice with 12-in. Palliser projectiles. The most trying blow being that shown in Fig. 9, Pl. VII. By this blow the upper plates were driven 5½ in. back, but the turret worked freely. As the spot struck was on a 14-in. plate, and the shot nearly went through, no projectile of 12 in. diameter or less could produce much more distortion. Shot from new-type guns would perforate better, but they could not produce more distortion (for this can only be effected in the act of resistance to penetration); unless the shot's

* Krupp in 1879 marked out a space roughly representing the Inflexible deck on the range at Meppen; this was fired at by an 11-in. Howitzer at over 7000 yds. range. The first five shells fell close to the target, and the next five all struck it near the centre.

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diameter exceeded 12 in., which implies that the attacking gun is out of all proportion to the turret. This experiment, then, was very satisfactory for *wrought-iron* turrets. It must be remembered, however, that the use of *steel-faced and steel armour alters the conditions*, because, instead of yielding locally, the work delivered at the point of impact is distributed into the surrounding mass of armour. Steel-faced shields at Shoeburyness (as noticed in account of experiments, page 299) spring back bodily in a way that is unknown with wrought iron, and consequently the effect on impact may take the form of more distortion as penetration becomes less. How far this may tell practically cannot be said in the absence of actual trial.

A second round was fired at the Glatton turret at the junction of the turret with the glacis. This grazed the glacis plate and struck the turret close to it. The positions of this and the previous round also are shown in elevation in Fig. 10, Pl. VII. The shot-point entered to a depth of about 15 in. It was easily disengaged, and the working of the turret was not interfered with. The turret was made to revolve and fire after the firing was over.

Shah and Huascar.

"The two naval engagements in which the Huascar took part are interesting enough to deserve special notice. Not only were they fought by armourclads of the modern, if not of the most recent type, but the guns with which the armour-plating was attacked were rifled pieces, firing Palliser projectiles, and of the British pattern. Descriptions of the several ships will be found in other parts of this work, and it will be enough to give here the following short summary of their main features. The Shah is an iron-hulled, unarmoured frigate, cased with wood, with a displacement of 6040 tons. At her official trial in April, 1876, the indicated horse-power was 7350; and the total of the runs then made showed a mean speed of 16·4 knots an hour. Her armament in 1877 was composed of two 9-in. 12-ton guns, sixteen 7-in. 6½-ton guns, and eight 64-pdrs., all rifled muzzle-loaders, the last-named not firing battering projectiles. The Amethyst is an unarmoured corvette of the modern type, with a displacement of 1934 tons, of 2144 indicated horse-power, and carrying fourteen 64-pdr. guns. The complement of the Shah was 602, that of the Amethyst 226 officers and men. The Huascar is an iron-hulled, armourclad turret vessel of 1101 tons,* and 1500 indicated horse-power; at the time of the action she is said to have had new boilers, and to have been able to steam 11 knots easily. Her plating

* 2100 tons displacement, according to the *Revue Maritime*.

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on the hull is four inches thick, tapering to 2½ inches at the bow and stern. The turret-plating is 5½ in. in thickness. She carried two 10-in. 12-ton rifle muzzle-loading 300 pdrs. on Sir W. Armstrong's system, in a single turret, and two 40 pdr. muzzle-loaders, all rifled, on the quarter deck. The two British ships having sighted the armourclad gave chase, got up steam for full speed, and prepared for action. The Huascar tried to escape towards the land, but the Amethyst being in shore assisted to confuse her movements. She then stopped, and an officer was sent on board her by the British Admiral, with a demand to haul down her colours, which was not complied with. The action began at 3.6 P.M. The Shah's firing was telling and well-sustained; but the Huascar being only three feet out of water and frequently end on, was a most difficult object to hit. The Shah's guns were also frequently silenced by the Admiral's order when, owing to the Huascar placing herself close under the town of Ylo, there was a risk of injuring the town. The firing was also stopped for a little while in consequence of the Huascar's colours coming down. The halyards had been shot away; and the colours were soon rehoisted. The Amethyst's fire was conducted with great precision; but the armament of 64 pdrs. was useless, except to distract attention and draw the Huascar's fire occasionally off the Shah.

"The Huascar replied with shell from her turret guns, and continued manœuvring backwards and forwards in front of Ylo, her draught of water being 14 ft. and that of the Shah 27 ft. The navigation was rendered highly dangerous owing to the rocks and shoals at the entrance to the bay. The Shah's distance from the enemy was, consequently, principally from 1500 to 2500 yds. The engagement was partly a following and partly a revolving one, with occasional attempts on the part of the Huascar to ram, which had to be carefully guarded against with a ship so long in proportion to her beam, and therefore so slow in turning as the Shah. Owing to the size and weight of the latter ship and the confined space to manœuvre in, she was unable to benefit by steaming up to an effective range of 1000 or 1200 yds. and stopping to deliver a steady fire; the greater rapidity of the Peruvian's movements rendering such a proceeding dangerous, and the risk of being rammed before being able to 'gather way' again being too great. The Huascar appeared to steam about 11 knots, and always contrived to keep her turret guns pointing at her opponents' except when in their loading position. About 5 P.M., the turret-ship being clear of the shoals, advantage was taken of the opportunity to close. The Shah's

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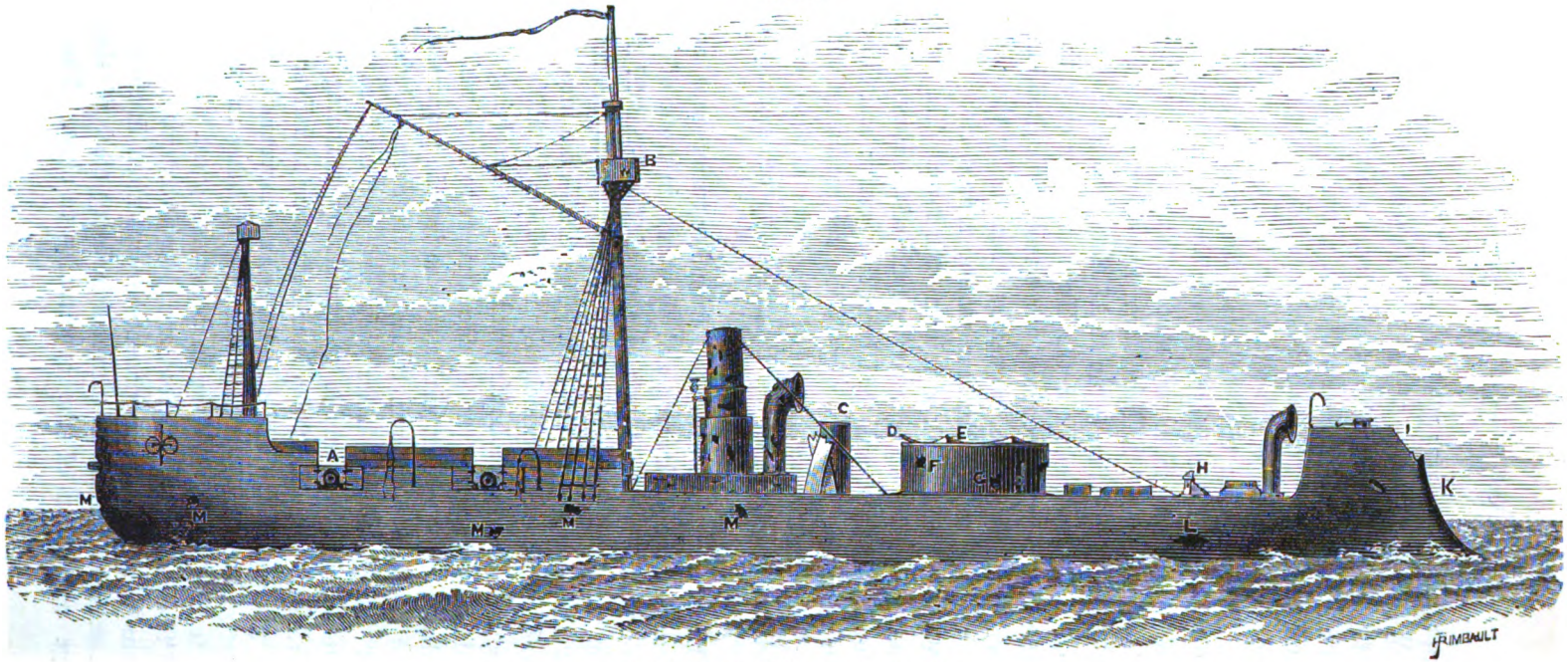
FIG. 1.



THE 'HUASCAR' (AFTER CAPTURE)

A. Quarter-deck gun. B. Screen round Gatling gun. C. Conning-tower. D, E. Injured roof of turret. F, G. Shots striking turret. H. Capstan. K. Stem. L. Shot through from port side. M. Shots striking starboard side.

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Gatling gun was then fired from the foretop. It was at this moment that the Whitehead torpedo was launched at the turret-ship. The action ceased at 5.45 P.M. No damage was done to either of the British ships beyond the cutting of a few ropes. The Peruvian had one man killed and three wounded.

"On a subsequent inspection, according to the approximate calculations of two British officers who visited the vessel, from seventy to eighty projectiles must have struck the Huascar, principally about the upper deck, funnel-casing, bridge, masts, and boats. Numbers of pieces of the shell were sticking in the woodwork. One 9-in. *common* shell struck the hull on the starboard side, about 2 ft. from the water-line and 50 ft. from the stern, in the foremost ward-room cabin. It burst in the backing, the head splintered in all directions, and the base continued its course till brought up against the inner skin on the opposite side. Don Manual Carrasco, in an official report, states that the explosion of this shell killed one seaman and wounded one officer and two men. The plating at the spot where it entered was about $3\frac{1}{2}$ in. thick. Two 64-pdr. shells left indentations on the plating. One heavy shot, evidently a ricochet, hit the upper edge on the starboard side, scoring it to a depth of 3 in. after going through the bulwark. Another hit the plating 2 ft. from the water-line at an angle, making a dent 2 in. in depth and 18 in. in length. On the port side there was a shot similar to the ricochet. The hull showed that several 64-pdrs. had struck it, only leaving a mark. One shot struck the poop on the port quarter and went out on the starboard side, splintering an iron beam. The funnel-casing and funnel had been hit about 12 times by shot and pierced by the Gatling gun. The turret had only been struck once by a 7-in. projectile, hitting direct and penetrating 3 ins.

Capture of the Huascar by the Chilians.

"The battle which resulted in the capture of the Huascar by a Chilian squadron, comprising two armourclads of recent design, conveys more exact information as to the effect of fire upon an armoured ship than that just described. The Huascar, accompanied by the unarmoured corvette Union, under Captain Grau, of the Peruvian Navy, was returning to the northward from a cruise along the Chilian coast when, about half-past three on the morning of October 8, 1879, she was sighted by a division of the Chilian squadron under Admiral Rivero. The Chilian flag-ship was the armourclad Blanco Encalada, and the two wooden unarmoured cruisers, the Covadonga and the Matias Cousino, were in company. It may here be proper to mention that the Blanco Encalada and the Almirante Cochrane, which subsequently took a decisive part in the

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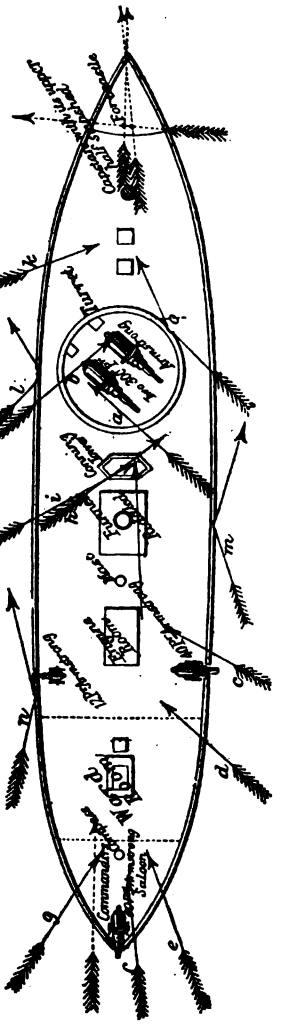
action, are sister ships, and are described elsewhere in this work. Their displacement is about 3480 tons, they each carry six 9-in. 12-ton muzzle-loading Armstrong guns, have 9-in. armour on the sides, tapering to $4\frac{1}{2}$ in. at the ends, and 8-in. armour in the central battery, in which their guns are mounted. Their highest speed should be about 13 knots.

FIG. 2.



PLAN OF THE 'HUASCAR' (SHOWING HITS BY SHOT).
(*l*, *m*, *n*, *o*, glancing shots.)

"We now return to the more important incidents in the engagement. The Peruvian ships tried to escape to the northward, but their retreat was cut off by the appearance ahead of them of the second Chilian division with the Almirante Cochrane. At 8.40 A.M. this ship was about 3000 yards from the Huascar, which at 9.15 fired her first shot at the Almirante Cochrane. The latter did not reply, but continued to approach till her fire might be more effective; and a few minutes later a well-sustained fire began from both ships. The Blanco Encalada meanwhile neared the Peruvian, and drew off a part of the fire which had previously been concentrated on the Cochrane.

"As the fight went on, the vessels drew close together, and a gallant attempt was made by the Peruvian to dispose of his assailants with the ram. At one time the Huascar passed the Blanco at a distance of only about 25 yards, firing her guns and keeping up a warm discharge from the machine guns in her top. The Peruvian was eventually placed between two fires by the Chilian armourclads and was obliged to submit. The Covadonga fired one shot at the close. The engagement lasted precisely one hour and a-half, the Cochrane being under fire the whole time, and the Blanco only during the last fifty minutes. The Huascar had a complement of 200 officers and men. Captain Grau and 38 officers and men were killed; and among the

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162 prisoners 30 were wounded. The losses in the Chilian squadron were confined to the Cochrane, which had 12 men wounded, one mortally. The other ships escaped without a single casualty. The Huascar had been greatly injured by the fire of her opponents. The subjoined drawings give a general idea of her appearance after the battle, and of the state of the conning tower in which Captain Grau was killed. (See Figs. 1 and 2.)

"The Peruvian vessel was struck upwards of 20 times, and received more than a dozen severe blows. Mr. H. D. Pender, in a letter to the *United Service Gazette*, describes the effect of each important hit. Numbering the shots consecutively, in the order in which they appeared to him on going round the ship, he gives the following information :—

"No. 1. Starboard side. Struck the upper edge of the plating abreast the fore part of the turret, forcing up the deck-covering plate.

"No. 2. Penetrated the armour 18 in. above the water-line and over the engine-room, passing through the starboard waist cabins, over the engine-room platform, and bursting in the port cabins.

"No. 3. Penetrated just above the water-line, almost abreast of the stern-post, and burst in the ward-room.

"No. 4. Entered the after cabin, carrying away two beams and the sheave of the relieving tackle, and killing all the men steering.

"No. 5. This was a fore-and-aft shot. It struck the stern under the upper deck, smashing the stern-post, carrying away bulkheads, and killing all the men at the tiller.

"No. 6. Entered on the port side, opposite No. 4 shot, 2 ft. above water, bursting inside the pantry.

"No. 7. Struck the edge of the upper deck abreast the after part of the turret. The turret has a deep egg-shaped splash on it, probably from this shot.

"No. 8. Penetrated between the turret and the forecastle, 2 ft. 6 in. above the water, and burst in the carpenter's cabin.

"No. 9. This was an end-on shot fair on the cutwater at the deck line. It deflected upwards, carrying away bitts, &c.

"Two shots struck the turret, viz. :

"No. 10, which, looking at the turret from outside, but a little to the left of the right-hand gun-port, level with the trunnions, penetrated the turret between two plates right on the joint, hit the right trunnion of the right, and carried away the cap-square, compressor, &c. The gun was not injured, but its crew were all killed.

"No. 11 struck the turret near the top at right angles to the path of No. 10. It appeared to have exploded in the turret, as the webs of two of the transverse beams were cut away, leaving the flange, and

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the beams were not deep enough to admit of a whole shell passing through them. The upper part of the breech of the left gun was much scored; the carriage was intact. Some fragments of this shell passed out again at the upper edge of the turret, killing the officer second in command of the ship.

"Nos. 12, 13, and 14 struck and destroyed the hexagonal thinly armoured conning tower; and one killed Captain Grau.

"'On the main deck,' says Mr. Pender, 'the ward-room and stern cabin were quite destroyed; there was hardly a trace of the bulkhead; the contents of the state-rooms were strewn about the flooring, and the upper deck ceiling was one mass of powder* and disintegrated human remains.' The engines and boilers, and the turret-winches were untouched." †

III.

Attack of Alexandria Forts.

The attack of the forts of Alexandria in 1882 should be studied in works specially devoted to it, such as the English and American official reports. Major Walford, R.A., read a very full paper on it at the United Service Institution. Before discussing it briefly here, it is well to make one or two remarks as to its general character. First, it must be clearly understood that the case is not considered as an instance of a fight between ships and really powerful sea-forts. A thoroughly well defended harbour would have mines laid down rendering the movement of ships dangerous. The water would, perhaps, be divided up into imaginary squares, and mechanism might be provided for automatically directing guns on each spot. Possibly ships engaging at anchor might be assailed by rifled mortar or howitzer fire. Torpedo boats might also be encountered. In some cases there might be batteries on positions with high command. The existence of such elements would make an attack by sea a very serious matter. Undoubtedly such an operation would need special reasons to justify it.

In the case of Alexandria these dangers were not present, but complications and difficulties were not wanting: for example, circumstances demanded that the ships should be sparing of ammunition. The action was fought under conditions rendering it very difficult to distinguish the features of the forts, and to direct the fire to good purpose.

Moreover the vessels, with the exception of the Inflexible, were by no means the most heavily clad or powerfully armed possessed by England. The Thunderer class was wholly unrepresented.

* Probably marks of explosion. † Reprinted from *British Navy*, Vol. II.

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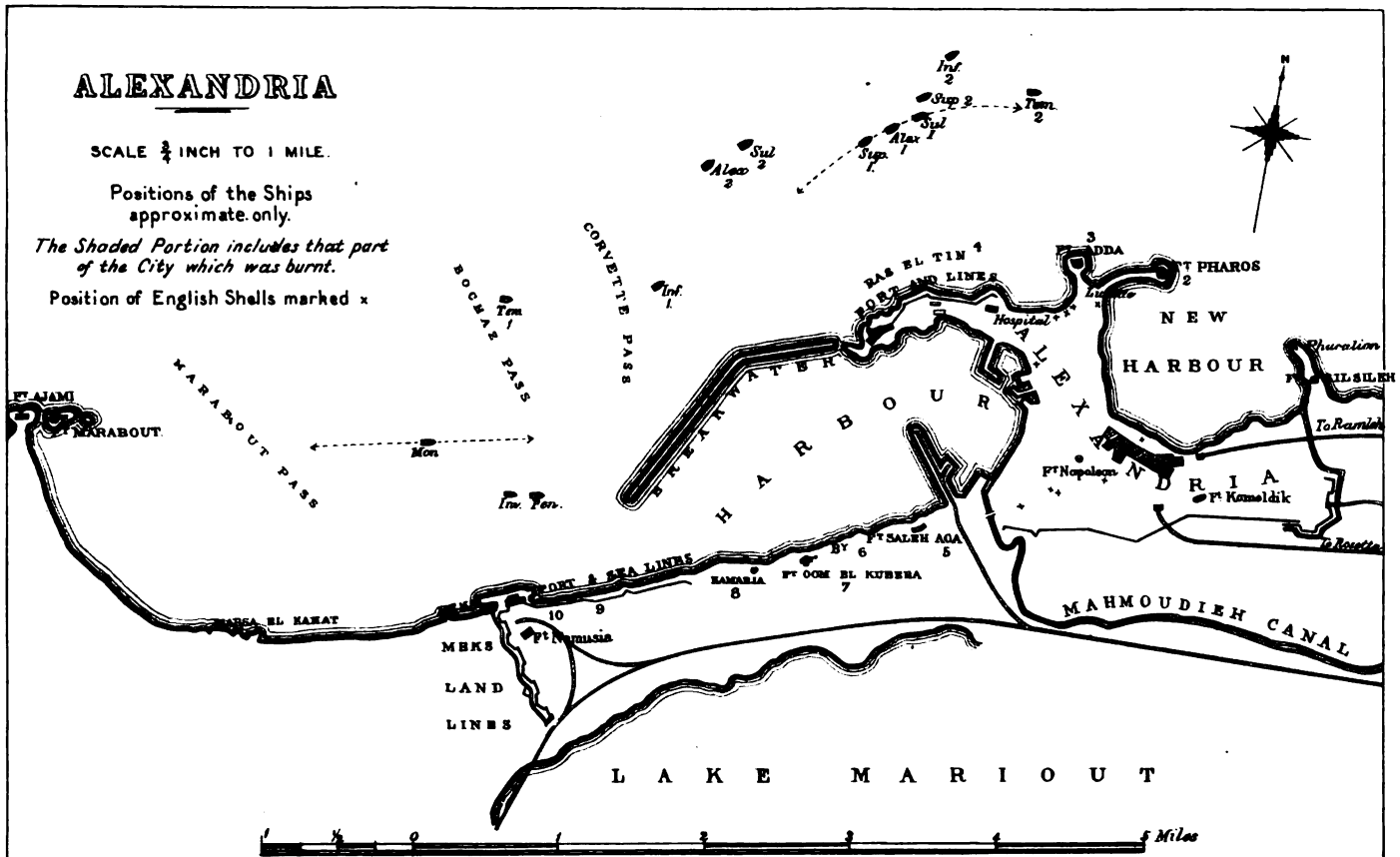

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The attack should be regarded then not as generally representative of what might occur, but as an important naval operation of a special kind whose complete success justified the judgment and skill with which it was conducted.

Certain British ships, the Invincible, Monarch, and Penelope, had been lying in the inner harbour of Alexandria up to July 10th, and they then moved into position in the outer harbour (*vide* plan, Pl. XIX.). To this may be perhaps attributed the fact that the Egyptians laid down no submarine mines, for it appears that they had an abundant supply of them, although only a limited quantity of cable was found. The general character of the attack may be seen from Lord Alcester's orders, which were as follows:—

"There will be two attacks. (1) From the inside of the harbour, in which the Invincible, Monarch, and Penelope, will take part. (2) By the Sultan, Superb, Temeraire, Alexandra, and Inflexible, from outside the breakwater."..."On the batteries opening on the off-shore squadron in reply, every effort will be made by ships to destroy the batteries on the Ras-el-Tin Peninsula, especially the light-house battery bearing on the harbour. When this is accomplished, the Sultan, Superb, and Alexandra, will move out to the eastward, and attack Fort Pharos, and, if possible, the Silsileh battery. The Inflexible will move down this afternoon to the position off the Corvette pass assigned to her yesterday, and be prepared to open fire on the guns in the Mex lines in support of the inshore squadron when signal is made. The Temeraire, Sultan, and Alexandra, will flank the works on Ras-el-Tin. The gun-vessels and gunboats will remain outside, and keep out of fire until a favourable opportunity offers of moving in to the attack of Mex."

The strength of the ships and forts that were to be thus engaged may be seen generally from the following Tables:—

Ship's Name.	Displacement in Tons.	Guns.									Armour. Maximum. Inches.	Draught of Water. Feet.
		80-Ton. 16-In.	25-Ton. 12-In.	25-Ton. 11-In.	18-Ton. 10-In.	12-Ton. 9-In.	9-Ton. 8-In.	64-Ton. 7-In.	64-Pr.	40-Pr.		
Inflexible (Turret) .	11,400	4	..	..	..	..	..	..	..	..	24 to 16	$25\frac{5}{12}$
Monarch (Turret) .	8,320	..	4	..	..	2	..	1	..	..	10 to 8	26
Temeraire (Barbette)	8,540	..	..	4	4	..	..	..	..	..	11 to 8	$27\frac{1}{2}$
Alexandra	9,490	..	..	2	10	..	..	..	..	..	12 to 8	$26\frac{1}{2}$
Sultan	9,290	..	..	..	8	4	..	..	..	..	9 to 6	$27\frac{1}{2}$
Invincible	6,010	..	..	..	..	10	..	..	4	..	8 to 6	$22\frac{3}{4}$
Superb	9,100	..	..	..	16	..	..	..	..	..	12	$26\frac{1}{2}$
Penelope	4,470	..	..	..	..	..	8	..	..	3	6 to 5	$17\frac{1}{2}$
Total Guns .		4	4	6	38	16	8	1	4	3		

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The batteries of Alexandria had the following armaments:—

RIFLED-GUNS.

Forts and No. on Plan.	Mounted.					Unmounted.		Total.
	10-in. ML.	9-in. ML.	8-in. ML.	7-in. ML.	40 Pr. BL.	10-in. ML.	9-in. ML.	
Silsileh (1) . . .	..	1	1	..	..	..	2	4
Pharos (2) . . .	1	3	2	..	2	..	..	8
Adda (3). . . .	1	3	1	..	..	..	..	5
Ras-el-Tin Lines (4)	1	3	2	2	1	..	..	9
Ras-el-Tin Fort (4)	1	4	1	..	..	..	..	6
Oom-el-Kubeba (7).	..	..	2	..	..	..	..	2
Mex Fort (10) . .	1	1	3	..	..	2	4	11
Total . .	5	15	12	2	3	2	6	45
Mounted Rifled Guns in all . . 37						Unmounted Guns 8		

SMOOTH-BORE GUNS AND MORTARS.

Fort or Battery and No. on Plan.	Guns.			Mortars.				Total S. B. Pieces.
	15-in.	10-in.	6·5-in.	20-in.	13-in.	12-in.	11-in.	
Fort Silsileh (1). . .	..	3	..	..	1	..	..	4
„ Pharos (2) . . .	..	6	31	..	4	..	..	41
„ Adda (3) . . .	..	14	..	..	5	..	..	19
Ras-el-Tin Lines (4)	4	15	11	1	6	1	2	40
Fort Ras-el-Tin (4)	2	5	21	..	1	..	2	31
„ Saleh Aga (5) . .	..	4	8	..	..	..	..	12
Battery (6)		2	2	..	..	..	..	4
Fort Oom-el-Kubeba (7)	..	6	10	..	1	1	..	18
„ Kamaria (8) . .	..	2	3	..	1	..	..	6
Mex Sea Lines (9) . .	4	11	9	..	..	..	..	24
„ Fort (10) . . .	..	4	5	..	3	2	..	14
Mounted S. B. Guns in all . 182				Mounted Mortars 31				213

It may be seen from the above Tables that while the guns of the fleet were much more powerful than those of the forts, some of the latter might, under reasonably favourable circumstances, perforate the armour of all the ships except the Inflexible.

The guns and projectiles were supplied from Elswick, and correspond to the service old type Woolwich M.L. armaments carried by the British vessels.

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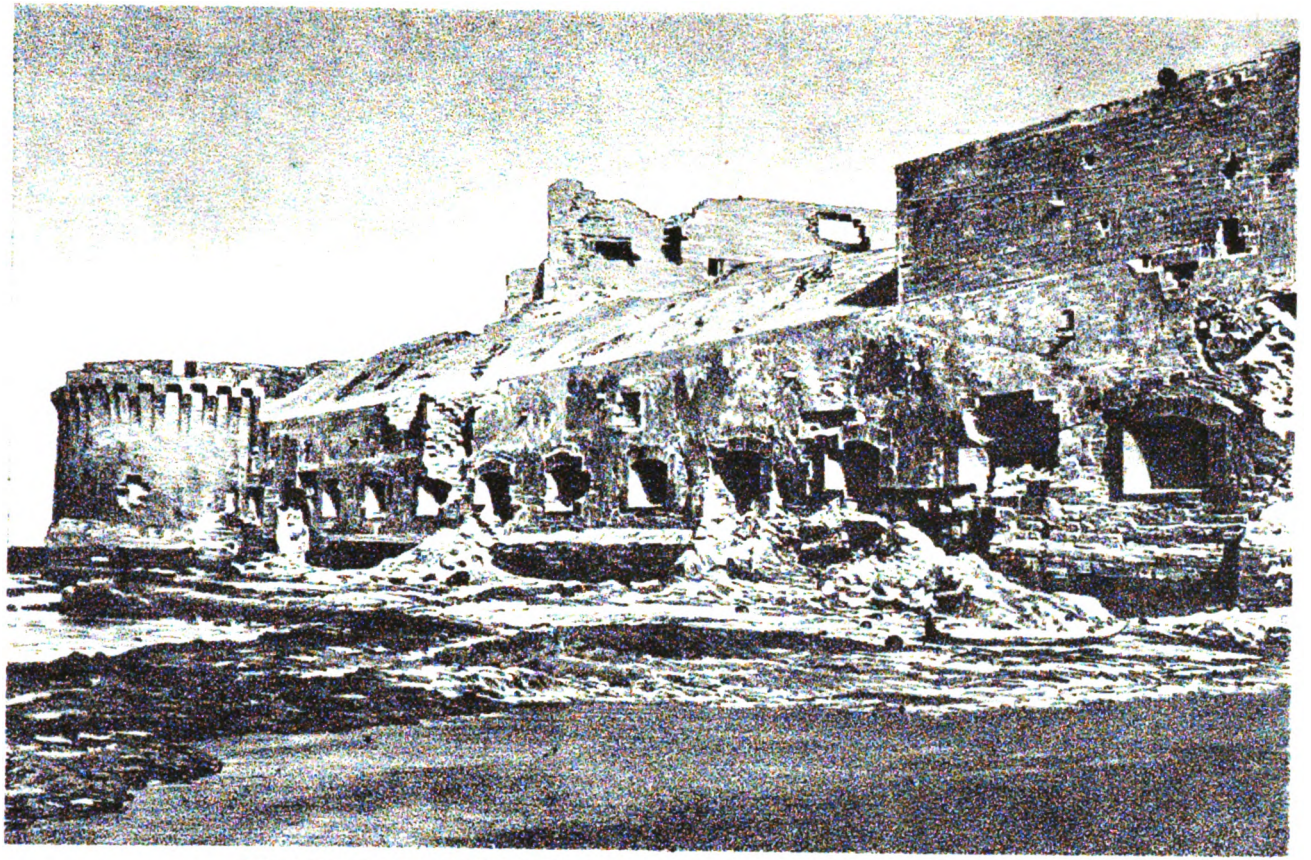

FORT PHAROS . NORTH-WEST FACE, THE PRINCIPAL ONE ENGAGED.
SHOWING THE EFFECT OF THE BRITISH SHELL.

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On the morning of July 11th, 1882, at about 7 A.M., the British fleet opened fire in the order detailed by Lord Alcester. The position of the ships may be seen approximately in the plan.

The Invincible (flagship) and Penelope engaged at anchor in the outer harbour against the earthworks at Fort Mex at 1500 yds. range. The Monarch acted with them under steam against Forts Mex and Oom-el-Kubeba, as well as eleven gunboats. The Temeraire supported the attack from the central pass into the harbour at about 4000 yds. range, and the Inflexible in the Corvette pass divided her fire between earth and masonry forts, Oom-el-Kubeba at 4000 yds., and Ras-el-Tin at 2700 yds. The Alexandra, Superb, and Sultan, engaged all forts betwen Ras-el-Tin and Pharos, chiefly, at first under steam, at from 1500 to 2000 yds., and at length anchored at about 2200 yds. distance. The gunboats, Helicon, Condor, Beacon, Bittern, Cygnet, and Decoy, assisted as opportunity offered.

At about 10.30 A.M. Ras-el-Tin and Mex Forts were to a great extent silenced, and the Alexandra, Sultan and Superb attacked the centre battery and other forts farther to the east, the Inflexible and Temeraire coming round and joining in the work. The Superb attacked Adda; the Temeraire, Pharos; and the Inflexible, both these forts. A shell from the Superb blew up the magazine in Adda, and silenced it about 2 P.M. The Monarch had silenced Oom-el-Kubeba about 1 P.M. The Temeraire, Inflexible, and Superb, silenced Fort Pharos about 2.30 P.M., and the centre battery ceased to reply to the Sultan and Alexandra about the same time. A battery at Hospital or Bluff point was the last one silenced at about 3 P.M. At about 1 o'clock a party in a boat very gallantly landed and destroyed the guns in Fort Mex.

The effect of the ships' fire on the various works was as follows:— Effect of Fire on

Fort Silsileh (not much engaged), a regular fort, chiefly earthwork, suffered little damage.

Fort Pharos, masonry with casemates, suffered severely, casemates riddled and choked. Three guns and carriages wrecked and others choked. One gun on the reverse face carried away and thrown on to its muzzle in the ditch 30 ft. distant. The rifled guns were silenced before the smooth bores in the casemates, although the loss of life in the latter must have been out of all proportion to that in the former. Pl. XX. gives a general idea of the effect of the fire.

Fort Adda, earth revetted with masonry. Parapets cut about but not materially injured. Three guns struck and put *hors de combat.* The fort was wrecked by the explosion of the magazine, otherwise it might have continued firing.

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Ras-el-Tin Lines (from Hospital battery to Ras-el-Tin Fort). Masonry and earth. No guns actually disabled although struck; several put out of action by being dismounted, or by the carriages being broken, or choked with *débris*.

Ras-el-Tin Fort (masonry and earth, but with thin parapets). All rifled guns fairly put out of action, either by fire of the fleet or by accident. This fort fought better and suffered more than any other. The parapets were much cut about and buildings riddled.

Fort Saleh Aga (an insignificant work, but with a command of 60 ft.). One S.B. gun dismounted.

Fort Oom-el-Kubeba (80 ft. command, masonry and earth, with good profile). Parapet suffered much from Inflexible 80-ton gun shells. One gun destroyed.

Fort Kamaria untouched, probably did not engage in action.

Mex Sea Lines, about 25 ft. highest command; guns firing *en barbette* over earth parapets, 15 to 18 ft. thick. One or more guns dismounted by fire of ships.

Mex Fort, 22 ft. command; guns *en barbette*; earth parapet unrevetted; parapets hardly injured, but buildings almost swept away. Three guns struck by shells and put out of action, and others by machine gun or shrapnel bullets. Two 10-in. guns received great protection from a wall some distance in front, which caught shells aimed at the guns; both the latter were struck, but not materially injured.

Fort Marsa-el-Kanat had no defensive power. Fort Marabout was attacked by gunboats. No guns were dismounted.

Effects on Ships.

The ships received the following injuries: The Inflexible, penetrated in unarmoured parts, and a good deal knocked about aloft. Monarch and Temeraire, untouched. Alexandra, struck sixty times, but not seriously injured. Sultan, Invincible, and Superb, armour indented, and minor injuries sustained.

The Penelope, hulled eight times, but no serious injuries caused. A small slice cut off one gun near the muzzle.

The *American Official Report* written by Lieut.-Commander Goodrich contains among other conclusions—

(1) Command is important for forts. (2) 30 ft. of earth stops all projectiles. (3) Embrasures should be cut deep below crest. (4) No guns should be mounted *en barbette*. (5) Guns should be painted the colour of the works. (6) The value of armour has been under-rated. (7) Modern guns with flat trajectories are not the best for attacking earthworks. (8) Some ships should carry howitzers. (9) Vertical fire should be studied. (10) Disappearing guns firing

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en barbette are very efficient. (11) Ships gain more in accuracy by anchoring than they lose in increased exposure to injury. (12) The swell told against the shooting, especially of ships engaging broadside on. (13) Shot not aimed at guns or magazines are thrown away. (14) Vessels do not fight on even terms with forts. (15) Forts could not stop ships. (16) The forts might have been repaired and action continued.

Major Walford, R.A., forms conclusions agreeing with some of the above, and points out the advantage of counter-guards in advance of batteries, also of traverses, parados and mantlets, and the evil of stone and brick in batteries. He recommends guns being strongly pivoted, well forward.

The additional suggestion may perhaps be made, that forts might mask or reserve their most powerful guns until they had drawn a large quantity of the ships' ammunition. It would be difficult for a fleet to detect such a practice, and the masked guns might obtain a better opportunity of damaging ships, if the latter became emboldened to draw in to closer range.

Special causes as noticed before made accurate firing from the ships almost impossible. The conditions of sunlight and of the works made it very difficult to distinguish the guns and objects aimed at. Admiral Le Hunte Ward, who commanded the Superb, states that while the vessels were in motion, it was necessary, as fast as the smoke cleared, to identify objects aimed at from a new point of view, and then to fire at them at an altered range. So difficult was this, that to deal effectually with the forts it was judged necessary to anchor.

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CHAPTER IV.

ORDNANCE.*

Ordnance. DURING the last five years very decided steps have been taken to enable the guns of Great Britain to maintain such a position as the country has a right to expect. That such steps were necessary can be stated on the authority of Colonel Maitland, the Superintendent of the Gun Factories, when reading a paper at the United Service Institution, with Lord Hartington, the Secretary of State for War, in the chair. The use of wrought iron had been persisted in long after the manufacture of steel had so far improved that steel hoops had been proved to be far superior to wrought iron coils. The reluctance to commit the country to any system of new type gun had been yielded to for a dangerously long time, while in the manufacture of powder England had undoubtedly fallen far behind Germany. This state of matters has happily come to an end. Steel hoops have entirely replaced wrought-iron coils, while experiments are pushed with steel riband, and the manufacture of German "cocoa" powder has been begun in this country at the same time that English powder has been greatly improved.

With regard to actual features of gun construction it must not be conceded that England was behindhand. Long new type guns had been made on designs and calculations of Captain Andrew

*_Authorities._—'Ordnance for Unarmoured Cruisers,' Lieutenant Very, U.S. Navy. Proceedings of Naval Institute, 1882.

'The Working of Steel for Guns,' Sir W. Armstrong. Mechanical section of British Association, Oct. 1882.

The Engineer—Krupp's Meppen experiments, 1882.

'The Heavy Guns of 1884,' by Colonel Maitland, R.A., Superintendent of the Royal Gun Factories, Woolwich. U.S.I. Proceedings, June, 1884. Two or three of these cuts of guns are brought up to date by being replaced by figures obtained from the Director of Artillery and Sir W. Armstrong. This paper, in an abbreviated shape, forms the main part of this section.

'Fired Powder,' by Lynal Thomas. *Illustrated Naval and Military Magazine*, July, 1884.

Army and Navy Journal, *Engineer* and R.A.I. Proceedings, 1885.

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Noble, long before Krupp surprised Europe with experiments on a large scale in 1879. The present system of construction resembles that of the original Armstrong gun in the fact that the guns are built up, while if in the use of steel it resembles the early Krupp guns. Steel now may be made with greater elongation even than wrought iron. The steel hoops when shrunk or in successive layers, offer in a higher degree the very advantages which formerly belonged specially to wrought-iron coils.

The chief change that has been made in guns since the first adoption of the long new type pieces, is an increase of strength in the chase, rendered necessary owing to the unexpected success in keeping up the pressure of the powder gas as the projectile nears the muzzle of the gun.

The fact should also be noticed that the action of the gas having become more that of a push and less of a blow, has seriously interfered with the success of those fuzes which depended on inertia to put them in action. A sensitive and yet safe fuze is now a very difficult design to accomplish, and the question cannot be said to be satisfactorily solved at the present time, either in England or abroad. The following incidents of the last four years may serve to record the course of events.

Very on Cruisers.

Lieut. E. Very, U.S. Navy, contributed a powerful and clearly written article to the Proceedings of the Naval Institute in the autumn of 1882, on the subject of the best ordnance for the unarmoured cruisers on which the United States place such great dependence. Lieut. Very, as one of the members of the "Advisory Board," had studied the subject and wrote with authority. He defended the adoption of guns which had by some been termed "pop guns," while he sought to show that it was futile to depend on merchant vessels for the class of war ship required to attack an enemy's commerce effectually. The structural conditions of compartment division and strength of scantling necessary for war service, would not be provided in merchantmen. He considered that the attempt to secure them by the English Government by the offer of a liberal subsidy had been a failure, and that the first necessity was to obtain ships capable, not of attacking armoured ships (which would involve the supply of guns which were very powerful, heavy, and therefore few in number), but of effectually disposing of merchantmen. This would be best done by the greatest possible number of guns of moderate power; such an armament, however, as would supply our unarmoured cruisers "not only with more powerful guns, but more of them than *any vessels of their own class* in the world." The

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question of how to get most work out of the 6-in. gun was discussed, quick powder being deemed best for light projectiles.

As to material, Very recommended guns built up of steel hoops. Wire he recognised as a possible future factor, but in too experimental a stage as yet. The tube he thought should not be oil-tempered, but the jacket might be so. The weight of the gun was to be 10,800 lbs. (about 4⅘ tons), the projectile was to weigh 80 lbs. this would be a design "neither modelled from Krupp or Armstrong," but "American throughout"; average power 118 foot-tons per inch circumference. Maximum, 135 foot-tons per inch or sufficient to pierce 12 in. of armour. It seems a pity that such a clear, able paper should rather be marred by insisting on the originality of what can only be original in a very minor sense.

Armstrong on Gun Steel.

In October, 1882, Sir W. Armstrong read a paper at the Mechanical Section of the British Association on the Working of Steel for Guns, giving some results obtained from very important experiments carried out by him at Elswick. The low percentage of carbon present in mild steel, and the fact that this class of steel has long been successfully welded, induced Sir W. Armstrong to make trial of steel coils for guns. Mild steel containing only 0·1 per cent. of carbon, with 13·5 tons limit of elasticity, and 23·3 tons ultimate tenacity, and 37·5 per cent. elongation, a piece 2 in. long being used, was taken. Tempered in oil it had 24 tons elastic limit, 28·6 tons ultimate tenacity, and 36 per cent. elongation. Two welded coils were made of this, and tempered in oil. One was applied as a jacket to a steel cylinder, in which powder was fired. To the surprise of all, this cylinder began to stretch laterally at a pressure which produced no change in a similar one jacketed with a wrought-iron coil. The second steel coil was laid aside, but afterwards the matter was again taken up, and it was found that a test piece cut along the coiled bar had only 12·5 tons elastic limit, 19·1 tons ultimate tenacity, and 7·5 per cent. elongation. A test piece taken across the coils, broke at the solid, showing a sound weld—elastic limit 12 tons, ultimate tenacity 20·1 tons, and elongation 6 per cent. The quality of the steel, however, was restored by hammering out again. The limit of elasticity rose again to 21 tons, ultimate tenacity to 27 tons, and elongation to 36·5 per cent. No further increase of strength was obtained by again tempering. The fracture in the weak state was coarse and granular, while both in the original and restored condition, it was slate-coloured and fibrous. It was found that at a lower heat than had been used, sound welds could not be obtained, and also that this heat was not injurious if no hammering took place. The metal

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stretched at 12·5 tons, but only broke at 25·2 (which was higher than the original bar untempered), and the elongation was 34 per cent. On the other hand, if hammered to half its thickness, it opened in fissures round its edges, wrought iron under the same test showing no such fissures.

Rejected gun steel containing 0·34 per cent. of carbon, deficient in tensile strength with 11 tons elasticity, 29·4 tons ultimate tenacity, and 24·25 per cent. elongation, when drawn out at red heat from 5 in. to 1¼ in. thickness, had 19 tons elasticity, 33·2 tons tenacity, and 27·5 per cent. elongation. Tempered in oil, it had 23 tons elasticity, 36·5 tons tenacity, and 21 per cent. elongation. This steel would not weld, but when again drawn out, was stronger than ever in the untempered state, the figures being respectively 24 tons, 33·6 tons and 15 per cent. Steel with more carbon, showed much greater effect from tempering.

Experiments with steel cylinders, showed that after tempering in oil, they could be reheated to 750° almost without appreciable effect on the metal. At higher temperatures, the effect of the previous tempering was in a measure undone, but not completely obliterated, even at the bright red heat at which it had been immersed in the oil.

Admiralty Experiments on Bending Steel, 1880.

With these experiments of Sir W. Armstrong, may naturally be connected the trials of steel coils in the Gun Factories of the Royal Arsenal, which resulted in the adoption of steel hoops in preference, and also the remarkable series of trials of mild steel plate, made by the direction of the Admiralty in 1880, to ascertain the heat at which mild steel is likely to fail in working.

Steel plates of thicknesses from ¼ in. to 1 in., and of tensile strain from 52·6 to 24·7, with elongations in 8 in. of $\frac{11}{16}$ in., and $2\frac{11}{16}$ in. respectively, were bent at a blue heat and cold, and in some instances, at a red heat also, with the extraordinary result, that while the metal scarcely ever failed to bend without difficulty when cold, it invariably cracked asunder at the bend at blue heat, sometimes before it had bent 20° from the straight line. Bending at dark straw colour heat, gave a similar result. At red heat, there was no difficulty in bending. Samples were taken from Cammell, Brown, the Bolton Steel Company, the Steel Company of Scotland, Parkhead Steel Works, and Landore Siemens in this series of experiments.

Krupp's Meppen Trials, 1882.

Krupp carried out a remarkable programme of experiments at Meppen, in March, 1882. In this were included two trials of perforation of armour dealt with on pp. 295 and 296. The principal features, omitting these, were the following: (1) Guns of 35 calibres long:—one of 30·5 cm. (12 in.), and another of 15 cm. (5·9 in.). These

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guns fire very heavy projectiles, and that with large charges. The performances were very good. It is natural to compare the 12-in. gun with the British 43-ton B.L. gun of the same calibre, though these are hardly representative guns now, which may be done by the help of the following Table:—

Weight.	Calibre.	Length of bore.	Charge.	Projectile.	Muzzle Velocity.	Muzzle Energy.	Pressure in bore.
		feet.	lbs.	lbs.	feet.	foot-tons.	tons per in.
Krupp 48·9 tons	12	35	324·1	1003·1	1725·8	20,715	18·3
Woolwich 43 „	12	25·5	400	714	2170	23,320	18·9
Do.	12	25·5			2050	20,810	

The long 15-cm. (5·9-in.) gun performed admirably, and in its character resembles the larger gun.

(2) A 21-cm. (8·27-in.) mortar, with 5 calibres length of bore, weighing only 1 ton 2¾ cwt., discharged common and shrapnel shell of 200 lbs. weight, or more than one-thirteenth part of the weight of the mortar. The practice was good. Steel shells were employed, which contained large bursting charges. Special ones, termed "torpedo" shells, were fired 6 calibres long, containing the enormous bursting charge of 106 lbs., made up of prismatic and fine grained powder.

(3) The 15-cm. (5·9-in.) gun, pivoted by its muzzle in a ball-and-socket joint of an improved pattern on that fired in 1877 and 1879, was fired.

(4) Guns for boats on fixed pivots with no recoil, and on spring pivots with very short recoil, were fired. The latter throws comparatively little shock on the boat.

Slow Powder.

The introduction of slow burning powder, as described in Colonel Maitland's paper (p. 348), gave the power of obtaining very high velocities with greatly diminished maximum pressures. The pressure was kept up, so that all the way to the muzzle of guns of greatly increased length, useful work was done by the gas. Development in this direction, eventually brought so much strain on the forward part of the guns, that repeated instances occurred of guns bursting at the chase when no flaw could be detected in the metal. The case of a 6-in. B.L. gun, which burst on board the Active, was specially investigated at Woolwich Arsenal. This gun, however, had been fired with only half the battering charge, and its failure can hardly be attributed to the above cause. A corresponding gun bore extraordinary tests in the Arsenal, projectiles being tripped up, as it were, by wedges, cold chisels, and the like, laid at some distance up the

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bore. Other guns burst on proof, and at Shoeburyness. It may be noticed, by the way, that a Krupp 11-in. gun, at Fort Heppens, burst on October 18th, the same month as a 6-in. Mark II. B.L. gun burst at Shoeburyness. In each case the steel barrel burst.

Construction of Guns.

On February 3rd, 1885, the Ordnance Committee were informed that recent accidents with new type B.L. guns had indicated the necessity of modifying, to a certain extent, their construction. Designs were submitted to the committee, both for strengthening existing guns, and for guns for future manufacture. For this special work, the following associates were added to the committee (viz.): Sir W. Armstrong, C.B., Sir F. Abel, C.B., Colonel E. Maitland, R.A., Captain A. Noble, C.B., and the late J. Leece, Esq. (of Whitworths). The following questions were specially referred:—I. Alteration of present mode of treating steel for guns. II. Alteration in present tests for gun steel. III. Any alteration in guns already made, in process of manufacture, and guns for future manufacture. The committee decided as follows:—As to (I.) treatment of steel. All steel tubes, whether forged as tubes or bored out from the solid, to be annealed before tempering, by raising the temperature gradually to the highest point that can be applied without injury, and then cooling gradually and uniformly. After tempering, the piece to be raised to a heat approaching that at which it was tempered and slowly cooled. II. The steel tests were to remain unaltered, except that certain relaxations were cancelled, and a hope was expressed that the forgings in their tubular state might eventually be tested by water pressure or other means. III. To meet the peculiar strain of slow burning powder, the chases of B.L. guns to be strengthened, each tube also to be as thin as possible for better annealing and examination. Detailed instructions as to the application of this principle to each pattern were given.

100-Ton Armstrong B.L. Gun

The 100-ton B.L. gun supplied from Elswick for the Italia, was first fired at Spezia in November, 1882. It was a remarkable design, apart from its magnitude. Guns in English barbette tower ships are mounted on the same principle. The guns being made without trunnions are brought very close together. The mounting designed by G. Rendel, is not here described, the question being dealt with at some length in the 'Manual of Naval Gunnery' prepared in 1885.

For the powers of the gun, *vide* p. 321.

The bare mention of the gun and carriage should be here made to record the date of so remarkable an advance in the power of artillery. Several guns of about 100 tons weight have been made by Sir W. Armstrong & Co. for the Italian Government, and deserve notice.

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The Duilio and Dandolo have each four 100-ton muzzle-loading guns. It was one of these that attacked the Schneider, Cammell and Brown plates in 1882. These have a calibre of 17·72 in.; they are made of wrought iron with steel tubes. The Italia has four trunnionless breech-loading 100-ton guns made of wrought iron and steel, with a calibre of 17 in.; the bore is 26 calibres long. The first of these guns was fired at Spezia, in November, 1882. The Lepanto has four 100-ton guns, nearly resembling those of the Italia, but slightly longer. The chief difference is that they are wholly made of steel. More powerful guns still are made for the Lauria, Doria, and Morosini—twelve in all. These differ chiefly from the Lepanto guns in being longer—that is, having a bore of 28 calibres in length; they weigh consequently 105 tons each. The only guns surpassing them in power are the 110½-ton guns ordered for the British Benbow; these are also made at Elswick, and are the most powerful guns existing. Thus since the first muzzle-loading 100-ton guns were tried at Spezia in 1876, the Italian Government have received, or are in the way to receive from Elswick, eight 100-ton muzzle-loading guns all afloat in the Duilio and Dandolo; eight 100-ton breech-loading guns for the Italia now in commission, and the Lepanto nearly completed; and twelve 105-ton breech-loading guns for the Lauria, Doria, and Morosini, which ships are in course of construction.

Krupp is supplying four 119-ton guns for turrets to protect Spezia Harbour. They are probably of about the same power as the Elswick 100-ton B.L. gun.

Maitland on Heavy Guns.

On June 20, 1884, Colonel Maitland, R.A., the Superintendent of the Royal Gun Factories, Woolwich, read a paper describing the position of England as compared with other Powers in the matter of artillery, under the title of 'The Heavy Guns of 1884.' The Secretary of State for War, Lord Hartington, was in the chair, and the paper is of such authority and importance that it is given herewith as fully as space will allow, using Colonel Maitland's words as far as possible.

Putting aside all minor considerations, the chief causes which have led to the re-armament of England, and which have brought about increased efficiency in heavy guns, are three:—

1. Improvement in powder.
2. Improvement in mechanical appliances.
3. Improvement in production of large masses of steel.

It will perhaps be said that if this be true, these considerations

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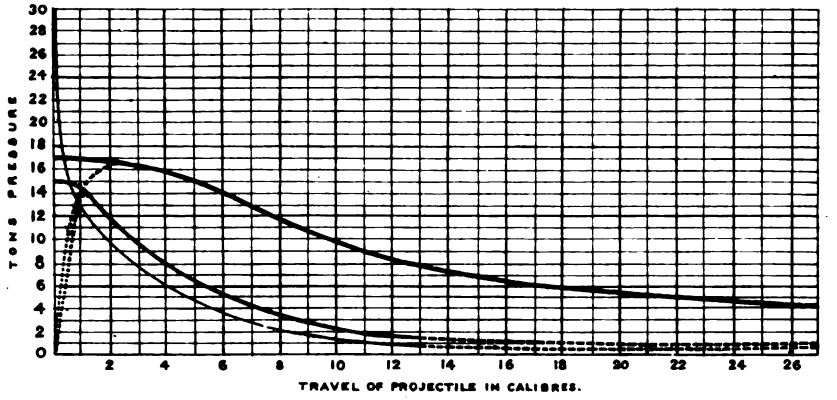
FIG. 1. COMPARATIVE POWDER PRESSURES.



BREECH ACTION. *FRENCH MARINE SERVICE.*

FIG. 2. BREECH ACTION. *KRUPP.*

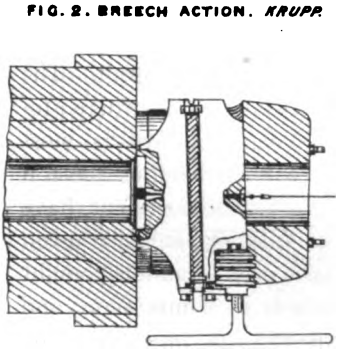


FIG. 3

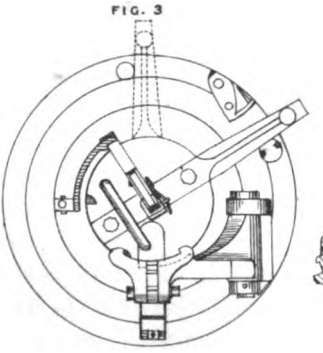
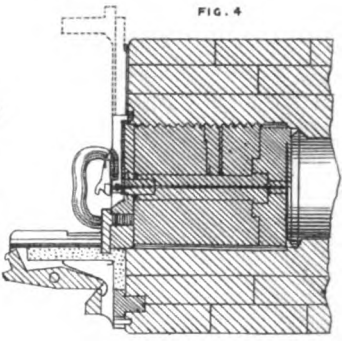


FIG. 4



BREECH ACTION. *FRENCH LAND SERVICE.*

FIG. 5

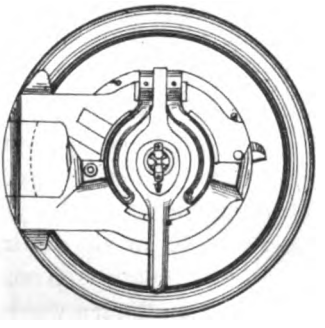
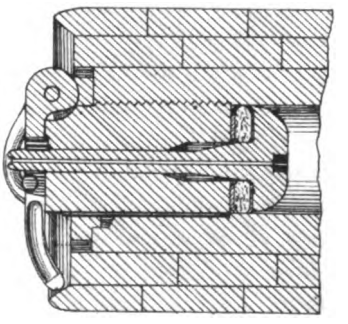


FIG. 6



6 INCH B.L. GUN. 80 CWT.
BREECH ACTION.
E.O.C.

FIG. 7.

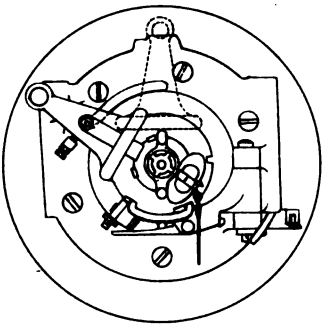
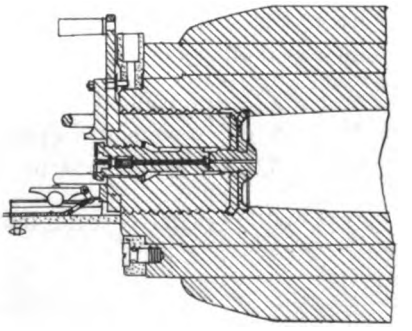


FIG. 8.



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HANHART LITH

MAITLAND ON HEAVY GUNS.

37 ⅝ (14·56 INCH) B.L. GUN. 71 TONS.
FRENCH, 1884.

FIG. 16.

40 ⅝ (15·75 INCH) B.L. GUN. 119 TONS. KRUPP, 1884.
SECTION.

FIG. 15.

OUTLINE

FIG. 14.

40 ⅝ (15·75 INCH) B.L. GUN. 71 TONS. KRUPP, 1881.
SECTION.

FIG. 13.

6 INCH B.L. GUN. 89 CWT.
BREECH ACTION.
R.G.F.

FIG. 10.

FIG. 9.

7 INCH B.L. GUNS. 10 TONS.
BREECH ACTION. R.G.F.

FIG. 12.

FIG. 11.

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should affect other nations besides our own, and that the great Continental Powers should be re-arming extensively also.

To this it may be replied that this is exactly what they are doing, and have been doing for some time past. Their re-armament is being carried out rather more gradually than ours, and the changes they are making are less radical, but none the less are they thoroughly re-arming. It may be admitted that during the latter part of the seventies England fell behind in the artillery race, but not to the extent that is supposed by many who have not thoroughly studied the subject. As a matter of fact, the old short breech-loaders of the Continent are just as obsolete now as the old short muzzle-loaders of England, and up to about 1875 or 1876 the British artillery was as good as anybody else's. Then came a period of comparative stagnation, and we fell to leeward. During the last three years we have been endeavouring to make up our leeway.

One point we have in our favour. In a science which advances as fast as artillery has been doing of late years, the Power which waits longest before committing itself to a new manufacture has the best of it, always supposing that it is not caught napping by an important war.

To come now to the improvement which has taken place in powder. The proportion between the energy attained by the projectile and the weight of the gun forms a convenient way of comparing the excellence of various designs. It is briefly called "energy per ton." Conversely, the description of powder which enables a gun to realise the greatest energy per ton without exceeding the pressures which it is constructed to bear, will be the best for that gun, irrespective of the quantity of powder expended in producing that result. As a rule the size of the cartridge is of little importance when compared with the advantage of increased power.

With breech-loaders that powder is found to be the best which satisfies the following conditions. It should fill the chamber of the gun as completely as is consistent with facility of loading. It should burn slowly at first, till the projectile begins to move, gradually setting up just the maximum pressure suitable to the gun; it should then burn faster and faster as the projectile travels onward through the bore, so as to keep up the pressure as long as possible, and give the greatest amount of energy.

Diagram Fig. 1, Pl. XXI. shows clearly the amount of progress which has been attained in slowing the powder and producing energy per ton of gun.

The ordinates represent the pressure of the gas measured in tons

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per square in.; the abscissæ show the length of travel of the projectile along the bore measured in calibres.

The fine curve indicates the pressures with quick burning powder, the medium curve with medium powder, and the thick curve with slow powder. The quick and medium powders were used in short guns, and the dotted portion of their curves is merely added to show how little gain would have resulted from increase of length. The slow powder is used in long guns, and the amount of pressure kept up to the muzzle indicates that we can go still further in the direction of length with advantage. The area included by these curves of course represents the work done by the powder, nearly all of which goes to produce energy in the projectile.

It at once becomes evident that to get an increased ratio of power to weight, we had to turn thickness of metal at the breech into length at the muzzle: that is, to lower the pressure in the chamber and keep it up longer in the bore.

There are two reasons why this improvement in the powder renders breech-loading an absolute necessity. First, the guns have to be made so long that loading from the muzzle becomes practically impossible on service. Second, the slow powder cannot be made to burn in the most effective manner unless the projectile be held fast by a strong band which prevents it from moving till a pressure of from 1 to 2 tons per square inch is set up in the chamber. This can only be done in breech-loading guns, and hence they are capable of developing greater power than can be obtained from muzzle-loaders of equal weight.

In 1880 we were using for our heavy muzzle-loaders either Waltham P_2 or German prismatic powder, which gave, when proved in the 38-ton M.L. guns, pressures of about 19 tons, and velocities of 1560 f.s. Directly the Royal Gun Factory came to breech-loading, the unsuitability of these powders became apparent to us, though the German prismatic powder was specially manufactured for Krupp breech-loaders. The Superintendent of the Royal Gunpowder Factory at Waltham was promptly asked to make a powder which should give about 800 f.s. velocity in the 38-ton gun with a pressure of not more than 5 tons, using the same charges as with the German prismatic, and Colonel Brackenbury produced an admirable powder, which attained celebrity under the name of H_3. This powder was nearly useless for muzzle-loaders, but when fired in heavy breech-loaders gave by far the best results then known. A modification of it has now been introduced and issued for service as C_2. Since the production of H_3 the Germans have taken a fresh departure, and

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have quite lately produced a powder which seems to be a little better than C_2. It is known as cocoa powder, and its composition is a secret.

The speciality of this cocoa powder is that although it lights with great regularity and burns very slowly at first, yet when the projectile has got fairly under way it burns with tremendous rapidity.

The next point is the improvement made in the mechanical appliances of guns.

With a breech-loader the first necessity is a thoroughly satisfactory system of closing the breech.

During the seventies, four really serviceable methods of working the breech and sealing the escape of gas became available, and one of the great objections to breech-loading disappeared.

Two causes then, *i.e.*, the improvements in powder and breech actions, settled the question of breech-loading *versus* muzzle-loading; the third cause of re-armament, viz., the production of steel in large masses, affects construction only.

Were large masses of steel not available, we should still have to re-arm with breech-loaders; but the old system of construction would no doubt be retained, and the change we have made would not be of so radical and complete a character.

Now it is desirable to give some idea of the relative excellence of the latest types of heavy guns at home and abroad, selecting three separate features for comparison as being of a crucial character.

These features are—

1. The system of breech-loading and obturation.
2. The construction.
3. The power.

Breech Fittings.

Fig. 2, Pl. XXI. shows the Krupp system of breech-loading. It consists of a round-backed wedge, which is pushed in from the side of the breech and forced firmly home by a screw provided with handles; the face of the wedge is fitted with an easily removable flat plate, which abuts against a Broadwell ring let into a recess in the end of the bore. On firing, the gas presses the ring firmly against the flat plate, and renders escape impossible as long as the surfaces remain uninjured.

Figs. 3 and 4, Pl. XXI. show the French marine system. Here the bore is continued to the rear extremity of the piece, the breech-end forming an intermittent screw—that is, a screw having the threads intermittently left and slotted away. In the French marine the escape of gas is stopped very much as in Krupp's system by a

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Broadwell ring. The vent bush passes through the screw, and is fitted with a lock at the rear for firing percussion tubes. It is so arranged that the gun cannot be fired unless the breech-block is screwed properly home.

As in Krupp's guns, the parts liable to wear are very dependent for their duration on cleanliness and freedom from dust and grit, but when worn they are quickly and easily replaced.

Figs. 5 and 6, Pl. XXI. show the French land service system. Here we have the interrupted screw as in the marine, but the escape is sealed in quite a different manner. A stalk passes through the breech-block, its foot being secured on the exterior. The stalk has a mushroom-shaped head projecting into the bore. Round the neck of the stalk, just under the mushroom, is a collar or pad of asbestos secured in a canvas cover. When the gun is fired, the gas presses the mushroom against the asbestos collar, and squeezes it against the walls of the bore. It is found that this cuts off all escape.

Figs. 7 and 8, Pl. XXI. show the Elswick system, which consists of a flat-backed cup abutting against the slightly rounded face of the breech-block. The lips of the cup rest against a copper ring let in the walls of the bore. On firing, the gas presses back the cup against the rounded end of the breech-block, and thus forces the lips hard against the copper ring.

The cup takes up very little room in the chamber, but is very sensitive to grit and dirt, so that, as well as the copper ring, it requires renewal at uncertain and often frequent intervals. The cup itself can be replaced in a few minutes, but the copper ring takes several hours to extract and renew.

Figs. 9, 10, 11 and 12, Pl. XXII. show our present breech-closing arrangement as applied to the steel 6- and 7-in. guns. We began with the Elswick obturation, but the copper ring required to be removed at uncertain intervals, and the De Bange obturator was adopted.

It has one great theoretical defect; it appears extremely complicated. This, however, is not quite so serious as it seems at first sight, for not only is it difficult for the parts to get out of order, but any or all of them can be exchanged in two or three minutes as the fittings are all held together without any screws. The vent passes through the mushroom and stalk as in the French land service guns; a clutch-box on the rear end of the stalk carries a percussion lock similar to that of the French marine. The safeguards which cause the apparent complication of the action are numerous. The tube cannot be struck by the hammer, even though the lanyard be pulled, till the breech is screwed home. Should there be a missfire, the slide is drawn back to

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permit the exchange of the tube, and the new tube cannot be fired till the slide is pushed properly over the tube again. Should the slide not be properly pushed over the tube before loading, the action of closing the breech forces it home; but should the tube be sticking so far out of the vent that forcing the slide home would break it and perhaps explode the detonator, the slide yields, and the attempt to screw the breech-block home reveals the error. Should the thumb slip in cocking, the hammer will not fall on the striker so as to explode the tube, but on a projection which is removed when the lanyard is pulled.

The next point is construction.

The experimental breech-loading guns first designed followed implicitly the coil system of construction which owed its origin to Sir W. G. Armstrong. However, it was found impossible to vie with the stronger material which was in general use in Germany and France. Guns of wrought iron could not be made to possess the same power as guns of steel without an important excess of weight.

Efforts were made to preserve the advantages of the coil construction by employing a mild steel largely alloyed with manganese, which could be made to weld satisfactorily, and experiments were carried out in the Royal Gun Factory with wrought-iron coils, steel coils, and forged steel hoops. These resulted in the complete victory of the forged steel hoops, and in April, 1882, the first English heavy breech-loader, entirely of forged steel, a 12-in. of 43 tons, was proposed by the Royal Gun Factory.

The matter was so important that it formed the subject of an elaborate inquiry by the Ordnance Committee. They decided upon a general type of gun, which was based upon a design submitted by the Royal Gun Factory on the 21st July, 1882, and all the guns since made for the British Government have conformed substantially to this type.

Krupp 71-ton gun.

Fig. 13, Pl. XXII., shows the 71-ton Krupp gun of 1881. The great German manufacturer keeps the sections of his guns a profound secret, and hence the details must not be taken as authentic.

It should be said here that the Russian heavy guns are either made by Krupp on designs of similar character to this, or copied by the Russians in their own steel.

Krupp 119-ton gun.

Krupp's latest design is for a heavy gun weighing 119 tons, and 35 cals. long, *vide* Fig. 14, Pl. XXII., which shows the authentic outline of this grand weapon. The construction in Fig. 15 must be taken as guesswork as regards the actual dimensions of the parts. This is the heaviest gun in the world, and four are being made for

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the Italian land service (*vide* p. 319). It will be observed that the tube forms a lining extending from the muzzle to the face of the wedge, and that it is recessed at the end of the bore to receive the Broadwell ring. Over the tube is shrunk the breech-piece in which the wedge plays. Over the breech-piece are shrunk several hoops. Every portion is made of the finest gun steel.

In this construction the whole of the metal over the powder-chamber comes into play to sustain the transverse strain, which is transmitted from the tube to the breech-piece, and from the breech-piece to the superimposed hoops. Neither hoops nor tube, however, assist in bearing the longitudinal strain, which is entirely taken by the breech-piece.

French 71-ton gun. Fig. 16, Pl. XXII., shows the construction of the latest heavy French naval gun, 37-cm. of 71 tons, proposed by General Dard, the great French artillerist.

The 34-cm. gun consists of a very thick tube or body strengthened with layers of hoops. As in Krupp's guns, the whole of the metal comes into play transversely, but the longitudinal strain is taken by the tube alone.

8-in. gun. Fig. 23, Pl. XXIII., shows the 8-in. gun, Mark III., steel, 13 tons. In this the breech-piece bears the longitudinal strain. In larger guns there is additional provision to meet it.

Elswick 110-ton gun. In Fig. 17, Pl. XXIII., we have the section of the Elswick gun of 110* tons. This magnificent piece of ordnance is being manufactured for the British Government at the works of Sir W. G. Armstrong, Mitchell & Company, Newcastle-upon-Tyne. It is entirely of steel. The tube is thin, and extends only to the obturator, and the breech-screw works in the breech-piece, which is shrunk over the tube as in the typical design on Diagram 15. Three layers of hoops reinforce the breech-piece. Here also every part of the metal over the chamber assists in supporting the transverse strain. The breech-piece is assisted in supporting the longitudinal strain by the peculiar distribution of the hoops. A long hoop provided with stout shoulders forms the rear part of the first layer. Its front shoulder engages the rear shoulder of a long hoop, which forms the front part of the second layer, and carries a front exterior shoulder, against which the trunnion hoop, forming the middle part of the third layer, abuts. Hence we have a direct pull from the trunnion hoop to the shoulder on the breech-piece. For the sake of clearness the word trunnion hoop is used, but in reality there are no trunnions, the exterior of the hoop forms two rings which are held in a strong band attached to the slide.

* Now 110½, termed 111 tons.

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To prevent the inner tube from moving forward, in case the friction between it and the breech-piece should become relaxed on firing, a metal of the character of phosphor-bronze is run into a serrated recess at the front of the breech-piece.

In building up this gun the trunnion hoop forms a kind of water-shed, so to speak, that is, all the hoops behind it are put on from the breech, and all in front of it are put on from the muzzle. To assist friction in keeping them in place, phosphor-bronze is run into a serrated recess under the trunnion hoop.

Fig. 18, Pl. XXIII., represents the section of the 63-ton * guns now being made in the Royal Gun Factory. They are entirely of forged steel, which, with the exception of some of the smaller parts, comes in the rough state from Sir J. Whitworth & Company, who have, so far, met our requirements better than any other maker. In this design the tube is thinned down at the breech, and the breech-piece, which is shrunk over it, receives the breech-screw. The metal is disposed in fair conformity with the transverse strain expected, and considerable weight is saved in front of the trunnion ring. All the metal assists in taking the transverse strain, except a very small layer of which only half assists, as will be seen presently. Over the breech-piece a hoop extending the full length of the chamber is shrunk on, and the weakness of a joint at this important part is avoided. An exterior hoop of fair length reinforces the breech still further. It will be observed that there is a novel feature in the disposal of the hoops, so as to secure the greatest amount of longitudinal strength. Gun Factory 63-ton gun.

Fig. 19, Pl. XXIII., represents on a larger scale the manner in which hoops which abut against one another endways are linked together by outer hoops. The exterior of the inner hoop carries a ring which is slotted away so as to leave alternate projections and intervals. The interior of the outer hoop carries a corresponding ring, which is also slotted away so as to leave alternate projections and intervals. The outer hoop, expanded by heat, is passed over the inner hoop, so that the projections pass through the intervals; it is then turned so as to bring the projections of one hoop exactly in line with the projections of the other, thus preventing any longitudinal movement. The intervals are then filled up with long steel wedges. which are forcibly driven in. One wedge would be sufficient to prevent any circumferential shift, but all the intervals are filled up so that the strain from the interior on firing is directly transmitted to the whole of the outer hoop.

By this device the gun is stiffened at the joints, and held together

* Now 67 or 68 tons weight.

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longitudinally from the extreme breech end to a point far up the chase—an advantage in point of strength and safety possessed by no other design.

Having thus taken what seemed to be best of other people's, we have added a little of our own in the matter of locking all the parts of the gun together; hence it may be confidently said that coming last we really have got the best forged steel construction known.

Wire Guns.

This expression is used to avoid including constructions which involve the employment of wire, which may perhaps supersede those consisting entirely of forged steel. They are chiefly experimental, but some have been made and actually issued for service to Chili by the firm of Sir W. G. Armstrong, Mitchell & Company.

Competitive designs have been prepared for the War Office by the same great firm and by the Royal Gun Factory for guns of this kind. Fig. 20, Pl. XXIII., shows a section of the 18-ton wire-gun proposed by Elswick.

The Royal Gun Factory design submitted at the same time is shown on Fig. 21, Pl. XXIII.

In this construction the whole of the metal over the chamber assists in supporting the transverse strain. The longitudinal strength is divided about equally between the tube and the outer hoops, and is ample.

In considering the probability of forged steel constructions being supplanted by those containing wire, it must be borne in mind that the lighter the gun in proportion to its power, the more work is thrown on the carriage in checking and absorbing the recoil.

There is some doubt whether a practical limit has not already been reached in this respect with the latest patterns of forged steel guns; that is to say, any further reduction of weight in proportion to power may be found to necessitate more than a corresponding increase of weight to the carriage. Should experience prove this to be the case, there will be little advantage in the introduction of wire, except in certain special cases, such as siege howitzers, &c.

Our third and last point of comparison is the power developed by the various types of ordnance which have been now instanced. In this respect we have had nothing to learn from abroad. We owe much to the labours of the Explosives Committee, and much to the admirable experiments with fired gunpowder in closed vessels which were carried out in 1874 by Captain A. Noble of Elswick and Sir Frederick Abel, but our chief superiority is due to the practical results obtained with enlarged powder chambers and lengthened bores during a searching trial at the Royal Gun Factory in 1873;

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from these causes our ballistic knowledge has long been fuller and more complete than that of any of the Continental authorities; and it was really owing to this circumstance that England's guns held their ground as long as they did under the double disadvantage of being wrought-iron muzzle-loaders instead of steel breech-loaders.

Chambering.

The principle of chambering, that is, of enlarging that part of the bore which contains the explosive, depends upon a peculiarity in the action of powder charges which is not very generally known or understood. It is found that long narrow chambers, Fig. 22, Pl. XXIII., favour the development of "wave pressures," as they are called, in a surprising degree, and experience has clearly shown that to get the best effect out of the charge, the chamber should not be longer than from three to four times its diameter; with a powder which is slow in proportion to the size of the gun, it is generally safe to approach or possibly exceed four diameters in length; but with a powder quick in proportion to the size of the gun, it is often dangerous to exceed three diameters in length.

There are also certain incidental advantages in shortening the cartridge by chambering: the length of travel of the projectile and consequently its velocity at the muzzle are increased. The shell has not to be rammed so far in, and the cartridge is more compact and serviceable. The disadvantage lies in the necessity for making the gun stronger and therefore heavier over the powder charge; in fact the breech must be that due to the size of the chamber and not of the bore. Still the ballistic advantages outweigh this, and as you see by the following Table, the chambered guns beat all others in energy per ton.

Comparative Table of Powers of B.L. Guns, 1881–6.

Nature of Gun.	Date.	Weight of Gun.	Weight of Charge.	Weight of projectile	$\frac{aC}{aB}$	$\frac{W}{D^3}$	Muzzle Velocity.	Muzzle Energy.	Perforation of iron at 1,000 yards.	Energy per ton of Gun.
		Tons.	lbs.	lbs.	Ratio.		Ft.-secs.	Ft.-tons.	Inches.	Ft.-tons.
French, 34-cm. (13″·38)	1881	52	362	926	1·07	·39	1968	24,868	22·9	478
French, 37-cm. (14″·56)	1884	71	546	1180	1·02	·38	1955	31,272	24·5	440
Krupp, 40-cm. (15″·75)	1881	71	485	1715	1·21	·44	1703	34,502	23·8	486
Krupp, 40-cm. (15″·75)	1884	119	615	1632	1·31	·42	2017	46,061	29·2	387
Elswick, 17″ . . .	1882	100	772	2005	1·34	·41	1832	51,900	28·5	460
Elswick, 16″·25 . . .	1886	110¼	900	1800	1·69	·42	2214	61,200	35·0	554
R.G.F., 13″·5 . . .	1884	63	625	1250	1·78	·51	2050	36,415	28·6	569
R.G.F., 9″·2 wire . .	1884	19	330	380	2·32	·50	2520	16,736	23·2	880
Elswick, 9″·2 wire . .	1884	18	200	380	1·85	·50	2200	12,759	20·0	709

There is one more point where chambering will probably prove of

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great service. The special duty of all very heavy guns, either for land or sea service, is to get their projectiles through armour. The smashing or racking effect of a very heavy projectile of large diameter, striking with moderate velocity, may prove more effective than a lighter shot of smaller diameter and high velocity, or the reverse result may take place.

We can adapt our chambered guns to suit either scheme. Since the calibre does not bear any fixed relation to the diameter of chamber, we can either enlarge the bore, or reduce it by a thin lining, at pleasure, without interfering with the powder charge or its stronghold.

To recapitulate the principal points alluded to above, having come last among the Great Powers to steel breech-loaders, we have been able to select the best points from the various systems worked out by others. The material is that proved admirable chiefly by German experience; the system of breech-loading is that of the French land service; some parts of our present construction have been tested in Germany and some in France, while we have been able to improve on both, and solidify the whole structure in a marked degree. Not being hampered by the necessity for utilising old material, we have been able to devote all our energies to new guns of the best quality, instead of repairing and altering old guns of inferior type, as is being largely done all over the Continent. We have, moreover, greatly extended the ballistics of our guns, and have conferred on them unsurpassed power in proportion to their weight.

U. S. Gun-Foundry Board.

A Gun-Foundry Board was organised by the United States Government by Act of Congress, March 3rd, 1883, to decide on the question of how best to supply ordnance to the army and navy. In order to come to sound conclusions, the board, under the presidency of Admiral Simpson, visited England, France, and Russia, and made an abortive attempt to visit Krupp's works at Essen.

The necessity for this course arose from the fact that, since the American war, the armaments had naturally dropped in arrear. The States, unlike a European power, are not surrounded by powerful and dangerous neighbours, and may rightly spare the cost of armaments on the European scale. Still there comes a point below which it is not safe to descend. An American writer has recently calculated that any European ironclad fleet could force on New York the alternative of a large fine or the bombardment of a billion of dollars worth of destructible property, the main difficulty being the supply of coals to such a fleet. Without endorsing this view, the United States Government might well conclude that their armaments needed

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most serious attention now, and some provision to ensure a certain standard being maintained, and a means of supply established, which should be available in time of need. The setting up of government manufacturing establishments and of contract supply was the leading question.

The board concluded that England and Russia committed themselves to an unwise extent to private firms, while the dependence of Germany on Krupp's establishment they regarded as intolerable. France was considered to furnish an example of what is most wise and desirable, both with regard to contract work, and also with regard to the establishment of separate arsenals for army and navy.

The system of ordnance to be adopted in America would hardly be thought to fall within the range of the work prescribed for the board. Nevertheless it may be seen that as the course recommended depends in a great measure on the article that is to be supplied, the latter has within certain limits to be fixed in order to recommend definitely the course to be followed.

The board, it appears, concluded that the gun of the future would be built up of steel hoops. Hence it was recommended that the various parts should be supplied by contract, and built up in government factories. Consequently the government establishments were to be *factories*, not *foundries*, private establishments being encouraged to supply the steel hoops and other parts. The Board recommended that arsenals with gun factories should be maintained at Watervliet, West Troy, New York, and at Washington Yard, Columbia District; the former for the army, and the latter for the navy.

The work of the Gun-Foundry Board in Europe, that is, the notes made in the course of the visits, is brought out with good illustrations in a volume of the *Proceedings of the United States Naval Institute*, by Lieutenant Jaques, U.S.N.

In England, Elswick received considerable attention, especially as to its hydraulic machinery. The Royal Gun Factories were visited, but considered to be in a transition stage, and but limited attention seems to have been given to them, and justice is not done to them. The point, however, is noted that guns are made at the lowest price in the world there. Considering that the object of the board very soon resolved itself into an enquiry as to the best supply of steel parts for guns, it is not surprising that much more attention was bestowed on Whitworth's works than any other establishment. Unqualified approval is expressed of Whitworth steel.

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In France the establishments of Bourges, Ruelle, Messrs Marrel, St. Chamond, Terre Noire, and Le Creusot, are noticed. Messrs. Schneider's 100-ton hammer and 160-ton crane are specially mentioned. In Russia the Gun Factory and Aboukhoff Works are briefly dealt with.

As to design, Vavasseur's guns and carriages are mainly adopted, the former naturally lending themselves to the objects in view, inasmuch as Vavasseur has for many years done exactly the work proposed by the board, that is to say, he has built up guns of hoops of steel procured from other firms, and that the work has been done in a thoroughly sound scientific way is apparent to any one who compares the drawing of the Vavasseur gun, p. 49, *British Navy*, Vol. ii., with any of the guns of the most recent patterns in this work.

Manufacture of Guns for the U. S. Government.

In May, 1885, the *Army and Navy Journal* reported that considerable progress had been made in the manufacture of guns for which appropriation of money had been made. These guns are for the new cruisers, namely, four 8-in. B.L. guns in half turrets, eight 6-in. and two 5-in. B.L. for the Chicago, one 6-in. B.L. gun for the Dolphin, and four 8-in. guns and six 6-in. each for the Boston and Atalanta. Of the twenty-one 6-in. hooped B.L. guns, five had been completed, six were being made by the South Boston Iron Works, five by the West Point Iron Works, and five at the Washington Navy Yard. The steel forgings for all these were made by the Midvale Steel Company of Philadelphia, An experimental 6-in. wire-bound gun is also to be made.

Moncrieff Mountings.

On April 25th, 1884, Colonel Moncrieff read a paper on the application of his hydropneumatic carriages to harbour defence, at the United Service Institution, in which he pointed out that, while the need of defending British harbours had been specially urged lately by Sir C. Nugent, the power of machine-gun fire had been dealt with by Lord Charles Beresford. The need of disappearing-gun carriages was therefore apparent in order to save the detachment from the continuous stream of fire that might be directed on to them. He considered that guns *en barbette* were out of the question. Iron-plated batteries with their magazines formed a very visible mark for fire, and were costly and less efficient and safe than the "disappearing" or "protected barbette" system. Many committees had sat upon the subject, each one eventually recommending the Moncrieff system, and thereupon being abolished. It was stated that, while only a few guns were mounted on Moncrieff counterweight carriages by England, as in the Severn and Cork defences, and in Bermuda and other colonial stations, they had been employed in foreign countries.

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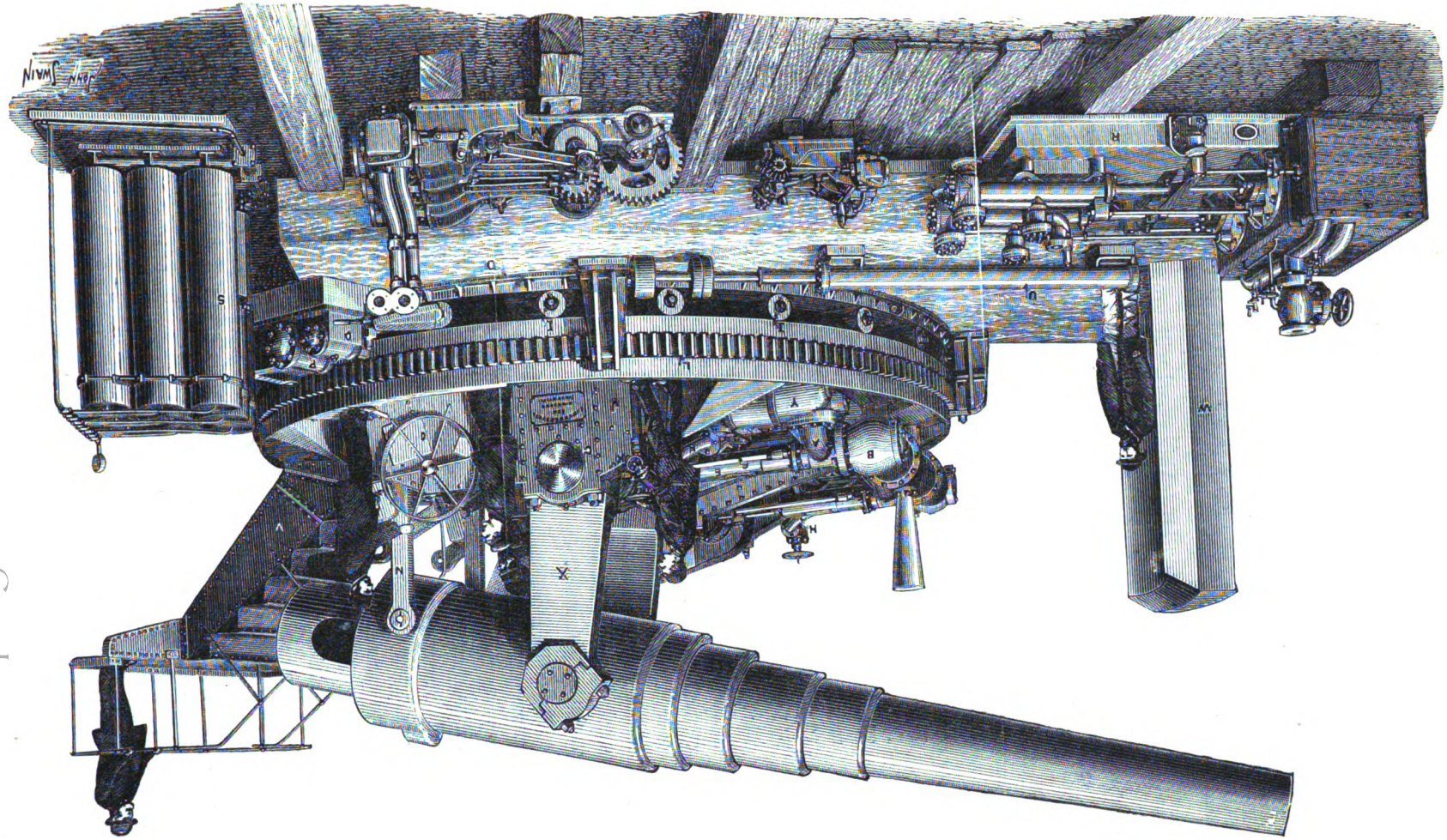

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For trial of Moncrieff mounting by ship's fire, *vide* Portland Experiment, p. 367.

Russian Moncrieff Ship's Carriages.

Hydropneumatic carriages have been adopted for ships by Russia. The following is a brief description of some in course of construction at Messrs. Easton & Anderson's, at Erith, for the new Russian ironclad Catherine II. This vessel will probably have about 10,000 tons displacement. She is to carry six 50½-ton breech-loading guns in a central breastwork with steel plate protection overhead, somewhat resembling that adopted by the French in the Amiral Duperré and other barbette ships. The guns are in pairs on turn-tables, and have a large scope of all-round fire. The breastwork only extends to a height of 22 in. above the surrounding deck, so that the battery is not conspicuous, and the guns but little exposed to view even when in their firing position. The breastwork consists of 12 in. compound plates, made under Messrs. Cammell's direction in the new Russian factories, backed by about 12 in. of wood and a strong framework. The gun is very powerful. The projectile weighs 731 lbs., and the muzzle velocity is estimated at 1950 ft. per second. This gives 19,260 foot-tons energy with a perforation per inch circumference of 511·2 foot-tons, which is equivalent to the perforation of about 23·7 in. of iron.

The gun itself is made on the Krupp system. A large heavy central tube is strengthened by several layers of short steel hoops over it. The whole of the longitudinal strain falls on the inner tube, which supports the wedge on the Krupp system. The individual steel tubes taper, and consequently their thickness from end to end varies considerably.

In future patterns the Russians contemplate the adoption of the interrupted screw breech in place of the Krupp wedge. Whatever may be thought of the details, however, the gun is very powerful, and the battery, of course, most formidable. As six ships are to be made nearly of the same type and power, the addition to the Russian navy is very important.

The largest disappearing guns in our navy are the 11-in. 25-ton guns of the Temeraire; sanction, however, has just been obtained for the manufacture of Moncrieff carriages for new type long 10-in. 31-ton guns. The 51-ton guns therefore represent a very great advance in this matter.

The mounting shown in cut (p. 361) consists of a cast-steel roller path D in segments 21 ft. 9 in. (6·63 metres) diameter, secured to the main deck of the ship, upon which revolves, upon twenty-two

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live rollers I, I, I, and round a hollow steel central pivot, a platform composed of a cast-steel ring L, filled in with a thick wrought-iron deck, to which, as well as to the outer ring, two pairs of gun-carriage sides J are bolted and riveted. The carriage sides are hollow, and composed of pairs of steel plates riveted to steel distance pieces. Each pair of sides carries, in bearings fitted with cap squares, a rocking shaft C, on which is secured a pair of levers X, the upper ends of which are formed into trunnion bearings, and fitted with cap squares, while the lower ends have a spindle through them to which is coupled a pair of connecting rods, the tail ends of which terminate in spherical ends which abut against steel hollow plungers working into the recoil cylinders Y. Each escape pipe A joins a valve chest B common to both. C is the rocking shaft. The recoil valve is so loaded by disc springs E as to adjust the hydraulic pressure. The gun platform is rotated by means of a steel pinion, actuated by a 3-cylinder engine acting on the teeth L. Elevation is accomplished by the elevating bars N, worked by screw-lifting gear. A brake P prevents excessive turning of the platform, and a bolt locks the platform. The water under pressure is pumped with an air accumulator S, composed of nine steel vessels. The ammunition is served by means of an endless chain actuated by small engines T, and rammed home by telescopic rammers U. V is the sighting platform. W represents the barbette wall.

British Naval Gun Carriages.

Elswick Carriages.

Rendel designs.

The gun carriages of the service have for many years been among the best features in British designs. They have been copied largely on the continent. With the exception of the Albini carriage they have been developed in England. Rendel's designs for the 100-ton and other heavy guns are very striking. Enormous forces are controlled by methods which are original, and as simple as they are scientific. The attachment of the gun to a plane hinged in front, the diminution of the moment or couple which formerly made the force of recoil specially injurious, and the abolition of trunnions, effecting saving of space, and simplification of other matters, such as the question of preponderance, are among the principal features of Elswick designs. These are well illustrated in the 'Manual of Gunnery.' As, however, it is desirable to give one or two typical naval carriages, the following are selected, and may be regarded as excellent. The designs are Vavasseur's.

Vavasseur Gun Mountings.

The principle features in the Vavasseur gun mountings are the following :—

(1.) The length of slide is arranged so that its rear end does not

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project behind the breech of the gun when in the firing position, the gun being thus quite clear for loading at the breech, while the mounting occupies a minimum space on the deck.

(2.) The length of recoil is made as great as practicable consistent with the above-mentioned condition. It is usually from 3 to 4 times the calibre of the gun on the mounting.

(3.) A high slide and low top carriage are used, hydraulic compressor cylinders being made as part of the top carriage, and placed as close beneath the trunnion bearings as possible.

(4.) The resistance given by compressors during recoil is made nearly uniform throughout with all charges, and automatically regulated by the gradual closing of the orifices in pistons, effected by the valves being turned during recoil by means of projecting tongues engaging in rifle grooves in the cylinders, so that, whatever the charge, the orifices are closed at about the same point, and consequently the length of recoil is nearly uniform on all mountings. This compressor is therefore free from complications which arise when pressure is controlled by springs, &c.

(5.) The compressor requires no attention during firing.

(6.) The compressor in the larger natures is also utilized to control the running out without interfering in any way with its arrangements for firing.

(7.) The gun can be elevated and trained while firing.

(8.) Shields are fitted to protect the mounting and gun's crew.

Vavasseur 6-inch Centre Pivot Mounting.

The Vavasseur 6-in. centre pivot mountings for H.M.S. Canada and Cordelia resemble each other in the general features of their design, but differ somewhat in their details. They are shown in Pl. XXIV.

The top carriage A is of cast steel, with hydraulic compressor cylinders B, either cast in one with it or inserted in it. It recoils upon rollers S^4, fitted in the upper part of the girders S^3 of slide; these girders are either built up of steel plates or are made in steel castings. They are connected together by a cast steel base S^2, having formed in it a large cylindrical socket, which works on the raised tubular portion of the pivot plate P^2, which forms the pivot holding the mounting. The slide is supported on four rollers, which bear on the turned racer at the outer edge of the pivot plate, and clips are fitted near the rollers engaging in the recess under the edge of the pivot plate, to prevent any jump on firing.

The compressor acts in a precisely similar way to that of the 9·2 broadside mounting.

The elevating gear is also similar to that of the broadside mountings.

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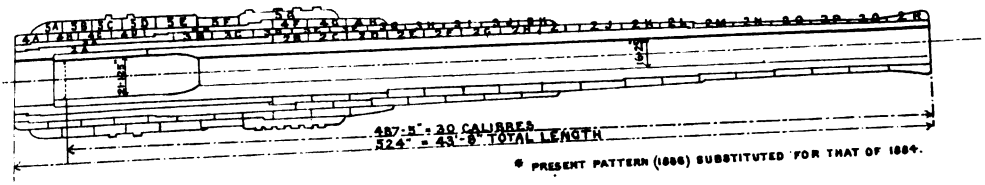
MAITLAND ON HEAVY GUNS.

FIG. 17.

16·25 INCH 110 TON B.L. GUN.*

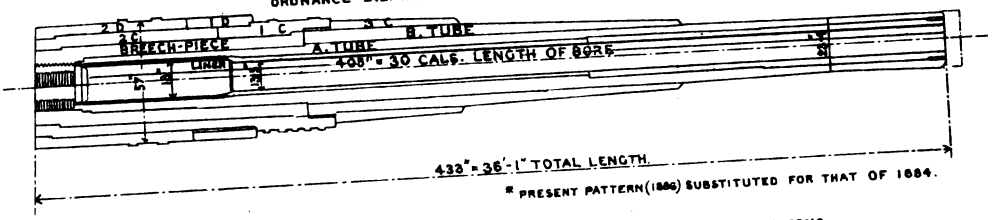
SECTION.



* PRESENT PATTERN (1886) SUBSTITUTED FOR THAT OF 1884.

FIG. 18.

ORDNANCE B.L. 13·5 INCH MARK II.* STEEL 67 TON.



* PRESENT PATTERN (1886) SUBSTITUTED FOR THAT OF 1884.

9·2 INCH B.L. WIRE GUN. 18 TONS.
E.O.C. 1884.

FIG. 20.

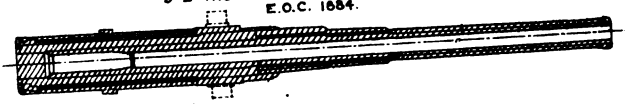
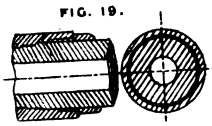


FIG. 19.



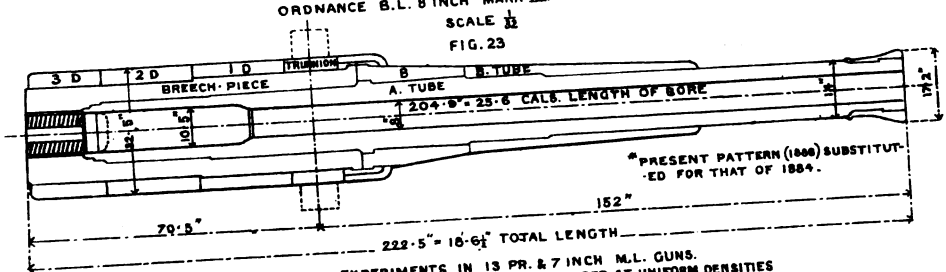
9·2 INCH B.L. WIRE GUN. 19 TONS.
R.G.F. 1884.

FIG. 21.

ORDNANCE B.L. 8 INCH MARK III.* STEEL 13 TONS.

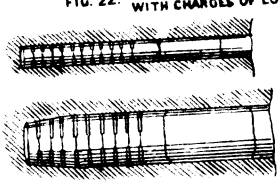
SCALE $\frac{1}{12}$

FIG. 23



*PRESENT PATTERN (1886) SUBSTITUTED FOR THAT OF 1884.

FIG. 22. EXPERIMENTS IN 13 PR. & 7 INCH M.L. GUNS.
WITH CHARGES OF LOT 116 R.L.G. 2 POWDER AT UNIFORM DENSITIES



	13 pr	7 inch.
DIAMETER OF CHAMBER	3·15 in.	7 in.
LENGTH " "	18·7 "	19·7 "
WEIGHT OF CHARGE	3 lb. 14½ oz	20 lb. 2 oz
" " PROJECTILE	13 lb	115 lb.
" " COLUMN OF PROJECTILE PER SQUARE INCH	1·9 lb	3·03 lb.
PRESSURE 1ST ROUND	28·3 tons	22·1 tons
" 2ND "	25·4 "	23·4 "
" 3RD "	37·6 "	20·7 "
" 4TH "	40·0 "	

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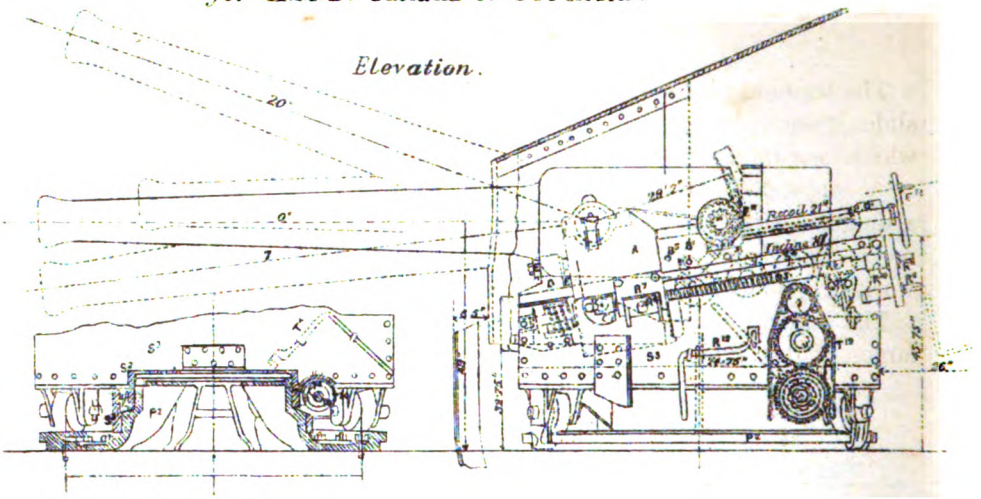
VAVASSEUR CENTRAL PIVOT MOUNTING FOR 6" INCH R.B.L. GUN

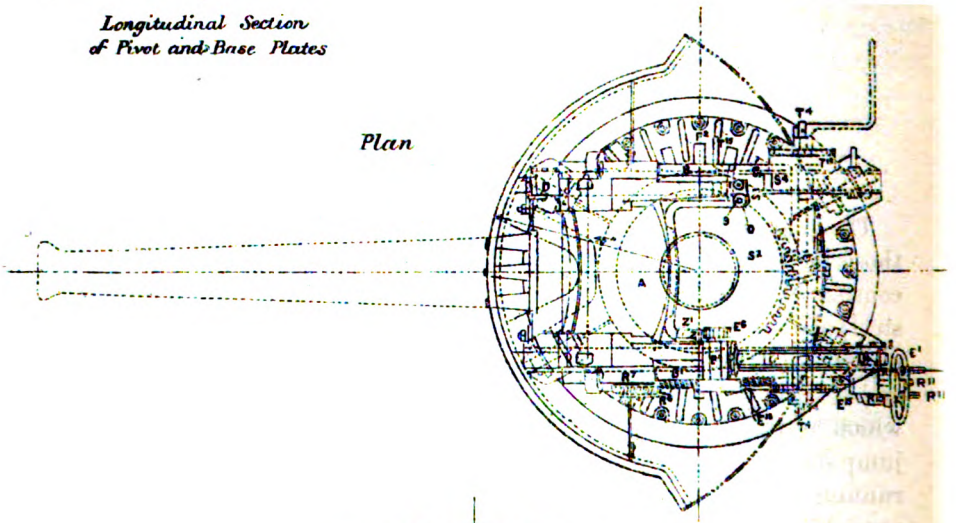
for H.M.S. "Canada" & "Cordelia".

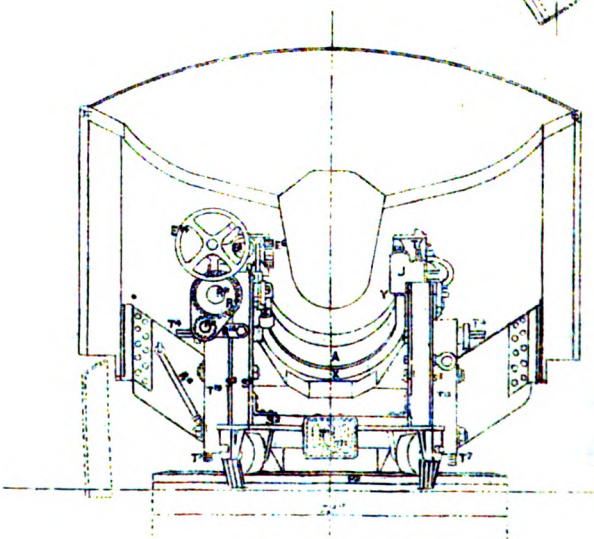
Elevation.



Longitudinal Section of Pivot and Base Plates

Plan





Rear End View.

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The training gear is worked by handles at T^4 on either side of the slide; these connect by the train of wheels with the worm T^9, T^{10}, which gear into the worm wheel T^{12} fixed on pivot plate.

A screw R^3 is fitted for running in the gun, a half-nut R^6 is arranged on the carriage, and is raised into gear and held there by means of the lever R^{13} when the screw is used, the latter being worked by handle at R^{11} at the rear end of the slide.

The mounting and guns crew are efficiently protected by the large circular shield which is carried by the slide.

Rate of Elevating, One turn of handle . . .	1·14°		
Do. Training do. do. . . .	2·37°		
	Cwt.	qr.	lbs.
Weight of Carriage	21	0	0
Do. Slide	56	3	6
Do. Pivot Plate	26	3	23
Total .	104	3	1
Do. Shield 1·24 in. thick	28	0	9

Vavasseur 5-inch roadside Mounting.

The Vavasseur 5 in. broadside mounting is of similar design to those for 4-in. and 6-in. guns. It is shown in Fig. 1, Pl. XXV. It consists of a top carriage *a* (4-in. and 5-in. of gun metal, 6-in. of cast steel) sliding on the upper faces of the side girders of slide *b*. The slide girders (of cast steel) are connected transversely by transoms at *c*, *d*, and *e*. The slide is supported at the front end by the transom *c* which rests on the pivot plate *f*, and also hooks under it to prevent jump on firing. The rear end of the slide is provided with rollers *g*, running on racer *h*. The slide is held at the front end by the sliding pivot block *i*, working in the pivot plate *f*, and pivoted on the pin *j* which acts only as a guide and takes no strain on firing. The front end of the mounting carries a protective shield plate *k*. The length of slide is arranged so that no part projects to the rear beyond the breech of the gun, which is left clear for loading.

The compressor consists of two hydraulic cylinders formed in the casting of the top carriage, each fitted with pistons and automatic rotating valves, with ports so formed as to give an equal resistance through nearly the whole length of recoil. Both piston-rods are in tension; they are connected to the slide at *l*.

The elevating gear consists of a pinion *m* gearing with the arc on the gun; on the same shaft as this pinion, but not rigidly secured thereto, is the worm wheel *n*; these wheels are connected so as to turn together by an arrangement of frictional discs, so that any jump

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of the gun on firing will only cause a slip on the discs, and not damage the gear. The worm wheel is driven by a worm on the long shaft *o*, and is worked by the handwheel *p*, which in firing position is sufficiently to the rear to be clear of the gun at end of recoil, and in reach of the gunner who can work the gear while looking along the sights. On firing, the worm slides along the shaft, the latter not turning during recoil; the gun can therefore be elevated while firing When not in use the shaft can, by removing the stop *q*, be run forward so that the wheel is at p^1.

Training is effected by the wheel *r* working on the rack *s*, and driven from the hand-wheel *t*, by means of intermediate wheels connecting it with the worm and wheel *u*, the latter being on the axis of the wheel *r*.

The small roller shown at *x* is for use in transporting.

The pawl *y* is for retaining the gun inboard or in housing position.

Vavasseur 9·2-in. Broadside Carriage.

The Vavasseur 9·2-in. broadside mounting is shown in Figs. 2 and 3, Pl. XXV. The top carriage *a* recoils upon rollers *b* fitted in the upper part of the girders *c* of slide; these girders are of cast steel, and are connected together by transoms. On the front end transom is formed the connection *d* to the pivot bar *e*. The slide is supported upon front rollers *f*, and rear rollers *g*, which run on racers *h* and *i* respectively. It is prevented from lifting at the front end by clips *k* engaging in a clip racer *l*. A protective shield plate *m* is fitted on the top carriage.

The compressor consists of two hydraulic cylinders formed in the casting of the top-carriage, each fitted with pistons and automatic rotating valves, with ports so arranged as to give nearly a uniform resistance during recoil, the length of which is 3 ft. 6 in. The right-hand piston-rod n^1 acts in tension, the left-hand n^2 in compression. The system is completely filled with liquid, and the fluid displaced by the entry of the left-hand piston-rod into its cylinder during recoil, passes through the rear connecting pipe n^3, raises the non-return valve n^4, and enters the right-hand cylinder, filling up the space left by the exit of the right-hand rod. The system is thus completely full in all positions on the slide. On running out, the right-hand piston-rod enters its cylinder, and as no liquid can return past the valve n^4, a by-pass is arranged, worked by handle n^5. When the by-pass is opened the liquid is free to circulate, and the gun runs out at a rate dependent on the amount by which it is opened; if closed before firing, the gun remains in at end of recoil, and can be stopped at any desired point on the slide by closing it when running out.

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FIG. 1.

VAVASSEUR 5 IN.

BROADSIDE MOUNTING.

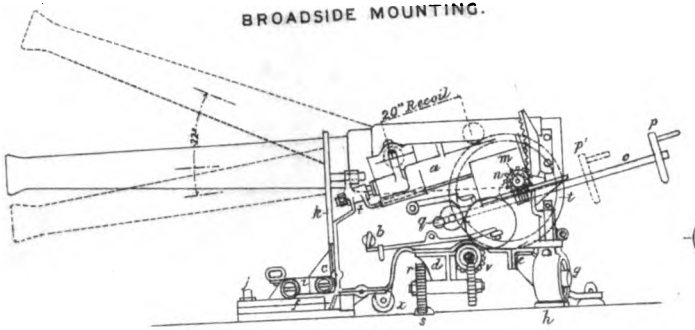


FIG. 3.

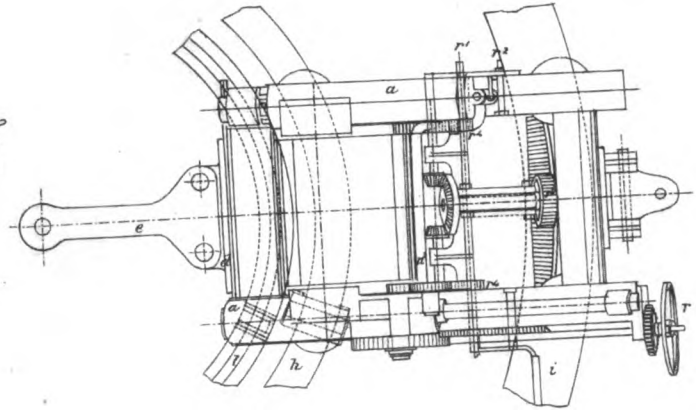
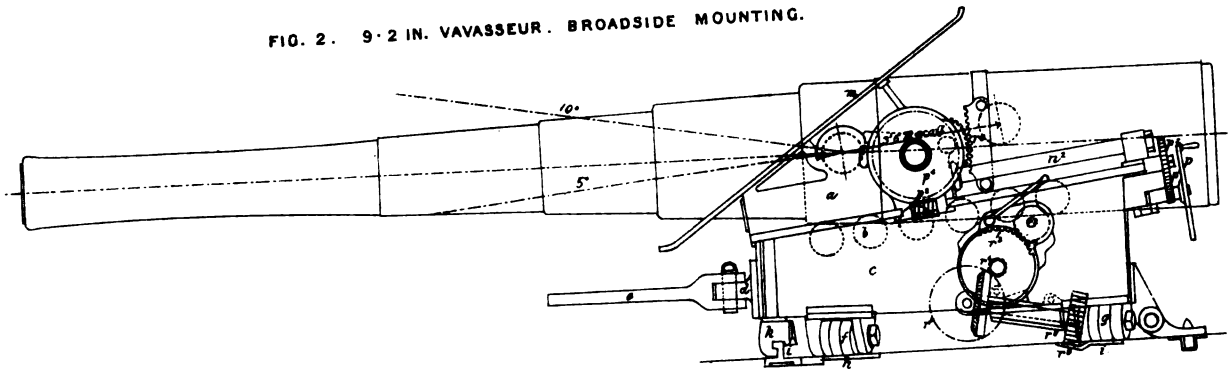


FIG. 2. 9·2 IN. VAVASSEUR. BROADSIDE MOUNTING.



Pl. XXV.

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MACHINE GUNS.

THE GATLING GUN.

FIG. 1.

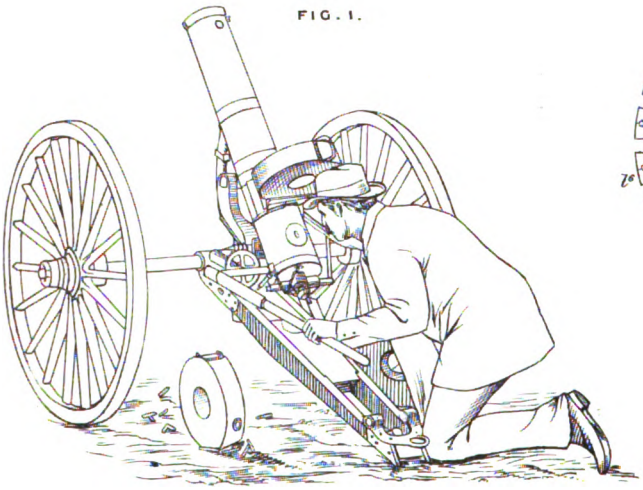

FIG. 4.

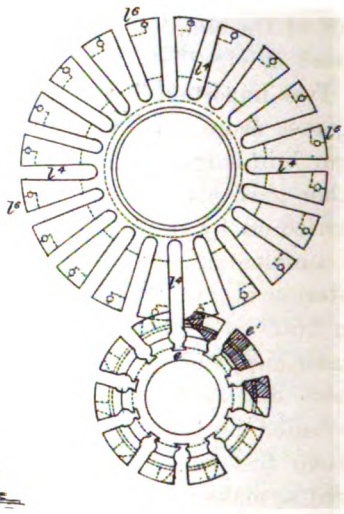

FIG. 2.

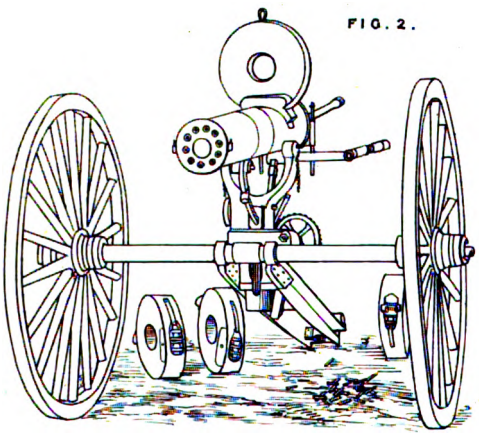

FIG. 3.

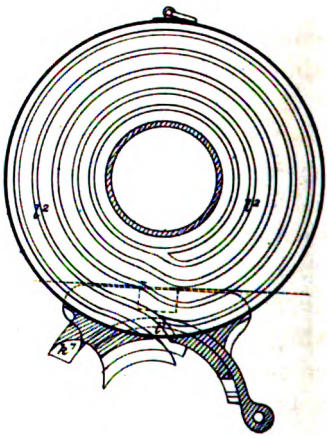

FIG. 5.

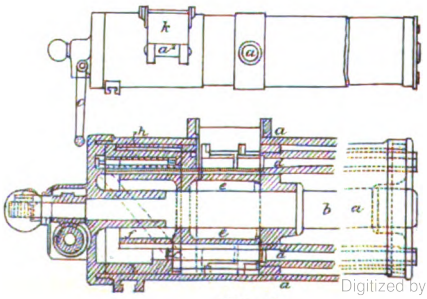

FIG. 6.

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The elevating gear is worked from the hand-wheel p through the wheels p^1, p^2, the shaft on which the latter is fixed driving the worm p^3, gearing with worm wheel p^4, connected to its shaft by frictional discs similarly to the arrangement described for the 5-in. mounting.

The training gear is arranged to be worked by handles on either side of the slide; for slow speed they are put on at r^1, r^1; for quick speed at r^2, r^2.

Inchkeith and Portland Experiments.

Two important trials were made as to the power of ship's guns against shore batteries. One was against a battery at Inchkeith near Edinburgh in 1884, which was fired at by H.M.S. Sultan. The other took place at Portland in November, 1885, the firing being carried on by H.M.S. Hercules. The report on the former trial was a confidential paper. The latter, which was on the whole of greater interest, was reported in the *Army and Navy Gazette* and elsewhere. In both trials the ship delivered its fire well. At Inchkeith smooth water and other circumstances favoured the ship. At Portland the shore battery was under very favourable conditions. The gun was mounted on the Moncrieff disappearing system, and was shown above the parapet for only 30 seconds at a time, and powder was fired to make a smoke as it disappeared. The first day the Hercules in motion, at about $\frac{2}{3}$-mile range, fired ten machine guns and one quick-firing 6-pr. gun, her heavy guns firing blank charges. The trial was continued for a period during which the Moncrieff gun appeared four times above the parapet, being exposed altogether for 2 minutes. The gun was struck several times, but it is hardly likely that it would be seriously injured by the projectiles of such small pieces,* unless they were to strike the metal normally. Had the detachment been exposed they would probably have been nearly all killed.

Some days after, the effect of the fire of the 10-inch guns was tried at a mile and a half range; but the sea was not smooth, and 25 shrapnel and some common shell gave but indifferent results.

Altogether the trial showed the value of the Moncrieff system, when guns are exposed to well-conducted fire from ships.

Bursting of a 43-ton gun on board H. M. S. Collingwood.

A 43-ton breech-loading gun burst on board H.M.S. Collingwood, while the armament of the vessel was being tested off the Isle of Wight, on Tuesday, May 4th, 1886. The gun is one of four, mounted in barbette towers, this one being the left gun of the after barbette. A scaling charge having been fired, the gun was loaded with a firing

* At Eastbourne a machine gun steel projectile entered the (wrought iron) chase of the turret gun, striking normally when the turret was turned partly round, and inflicted serious injury.

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charge of 221¼ lb. and a shell filled with water, weighing about 720 lb. On firing, the gun "went" at about 8 ft. from the muzzle, the steel tube in front of the strengthening hoop being broken to pieces, the fragments cutting the structure of the ship near the muzzle, but happily injuring no person. Being a trial day, Admiral Herbert, Admiral Hopkins, the Director of Naval Ordnance, as well as Captain Fisher, commanding H.M.S. Excellent, and representative officers from the Gun Factories, Ordnance Committee, and Admiralty, were present; also Mr. Vavasseur, on behalf of Sir W. Armstrong & Co.

The piece in question was one of eleven ordered on first approval of the pattern. It is known as Mark II., Mark I. differing chiefly from it in being a land-service gun with trunnions. This is a trunnionless gun made of wrought iron and steel, being one of the few guns which have steel coils in front of the trunnions. After the introduction of these two patterns, slower powder came in, yielding results with lower maximum pressures, but of course continuing high pressures further forward in the bore. This in conjunction, no doubt, with the difficulties attending the introduction of steel ordnance on a large scale, led to the guns being found too weak near the muzzle. One gun burst on board H.M.S. Active near the muzzle just as this one has done on board the Collingwood (*vide* p. 346). The special Committee then decided to strengthen guns in course of construction in the chase, and to make a stronger pattern for future manufacture. The case of the 43-ton gun was dealt with as follows: —"12-in. Marks I. and II. (steel tube and front coils, wrought iron jacket and breech piece) to remain unaltered, but the charge of 295 lb. cocoa powder not to be exceeded. Marks III. and IV. steel to be hooped to the muzzle. This will enable these guns to fire increased charges if desired, they being of steel and of sufficient strength at the breech. Mark V. (steel) for No Man's Fort, at present under consideration, to be made on a design having the chase made of a double tube, or tube in two thicknesses. Guns for future construction to be made on a design with a chase formed of a double tube." Thus, there exist five patterns of 43-ton or 12-in. breech-loading guns. Mark I. for L.S. and Mark II. for S.S. classed as less strong and limited as to charge. Mark III. L.S. and Mark IV. S.S., chase hooped to the muzzle, and Mark V. made double-tubed to the muzzle.

The Collingwood gun being Mark II. is the weaker sea-service pattern. It is greatly to be regretted that it should have burst. Such an accident must shake credit and confidence in our guns,

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especially occurring with so large a piece, but is not very difficult to understand or to remedy. The steel doubtless was weaker than usual from a flaw or some unperceived cause, and the tube consisted of a single thickness. The Committee, which it may be observed contains the highest authorities in the country, was directed to take up the matter again. The 43-ton Mark I. and II. guns in the mean time were ordered only to be used on emergency until they should be hooped to the muzzle, an operation which is being rapidly carried out.

The Ordnance Committee and associated Members in a Report, dated August, 1886, which was presented to Parliament, further recommended that the 43-ton guns, Marks I. and II., should be lined in the chamber. They also recommended that other guns of early patterns, which consisted of a single tube in the forward part, should be chase hooped.

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CHAPTER V.

Machine and Quick-Firing Guns.*

Machine guns were introduced for land service to play upon infantry which, under favourable conditions, are literally swept down by its fire. For naval service, besides their value in repelling boarders, they presented the best means of meeting the attack of torpedo boats, and for this purpose, larger calibres were adopted than seemed generally desirable on land, where, besides the essential quality of portability, the power of interchange of ammunition, with infantry, is desirable. This introduction of larger calibres renders it difficult to draw a line so as to distinguish machine guns from quick-firing shell guns, which subsequently came in, chiefly for the attack of unarmoured vessels or unarmoured portions of armour-clad vessels. If classified by their functions, the line between quick-firing and machine guns might be drawn at a barrel throwing a 14-oz. ball, seeing that international law does not permit of an explosive shell under that weight. Single barrelled pieces discharging fixed ammunition with projectiles exceeding 14 oz. in weight, and firing rapidly with provision to avoid relaying might, on this principle, be termed quick-firing guns: and all smaller guns, whether with one or more barrels, mounted on stands with mechanism for rapid discharge, might be termed machine guns. This, perhaps, is as good a line as can be drawn; yet it can hardly be maintained rigidly. Hotchkiss, for instance, has a four-pounder machine gun so called. Loading by hand has been proposed as the distinguishing feature of a quick-firing gun, but Nordenfelt has a design for one fed by hoppers.

The demand for mitrailleuses proper or machine guns to act against infantry arose about the time of the Franco-German War in 1871. The application of larger machine guns to meet the attack of torpedo boats came in about five years afterwards, and the idea of quick-firing guns to play on the unarmoured sides of ships was nearly five years subsequent to the "anti-torpedo" gun, the invitation for supply of such pieces being issued in 1881. In short, guns firing rapidly and continuously without the necessity of relaying may be most conveniently divided into three classes: (1) Smaller machine guns or

* *Authorities.*—The cuts and description of guns are taken chiefly from *Engineering* and the *Engineer*; a few also from *Iron*. Some of the facts and figures have been obtained directly from the Royal Arsenal and Shoeburyness, and from Nordenfelt.

'Machine Guns in the Field,' by Captain the Right Honourable Lord Charles Beresford, R.N. U.S.I. Proceedings, 1885.

'Treatise on Future Naval Battles,' by Admiral Sir G. Elliot, K.C.B.

'Side Armour *versus* Armoured Decks,' by Captain FitzGerald, R.N. U.S.I. Proceedings, 1885.

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mitrailleuses proper for bearing on infantry, firing only lead bullets and ammunition corresponding more or less with that of the infantry. (2) Larger machine guns or "anti-torpedo boat" guns, firing steel bullets. (3) Quick-firing guns, discharging shot, shell, and case, but all in the form of "fixed ammunition," that is, ammunition made up with its cap in a complete cartridge.

On the general scope of *machine guns*, a paper was read by Lord Charles Beresford, R.N., in the United Service Institution on July 4th, 1884. In this, the terrible devastation wrought by French machine guns at St. Privat and Mars le Tour is quoted, and the discredit thrown or attempted to be thrown on them is attributed to the totally mistaken principle on which they were pitted against artillery, instead of being devoted solely to the defence of bridges, breaches, and limited fields of ground over which infantry or cavalry had to act. The absence of recoil enables machine guns, and indeed, quick-firing guns also, to be ensconced in holes and corners where field guns would be unmanageable. Lord Charles Beresford has proposed a galloping machine gun carriage to accompany cavalry. This does not require to be unlimbered, and might even be fired when in motion. In July, 1883, at Dartford, Lord Charles Beresford with this gun, drawn by 2 horses, had fired 350 rounds from 7 stations during a run of two-thirds of a mile, advancing and retiring under cover against troops supposed to occupy a farm, in 5 minutes 55 seconds, including the halts which were long enough to fire 50 rounds from each station. The last few hundred yards of the distance had been galloped up a steep hill. The gun carriage was painted grey, and was barely recognizable to the naked eye at 300 yards range on the grass. A similar gun has been tried, with much success, by Sir Donald Stewart in India. The scope afforded by circumstances arising on service in the Zulu War, at Majuba Hill, in India, and Egypt, was dwelt on, and the gun and ammunition discussed in detail.

The chief function of *larger machine guns*, which is to disable or destroy torpedo boats, finds an illustration in Admiral Sir George Elliot's 'Treatise on Future Naval Battles.' The writer contemplates torpedo boats and torpedo catchers, approaching in advance of fleets, like lines of skirmishers on land. He proposes a special protection to ships' hulls against those which succeed in delivering their attack, but he contemplates a proportion of them being destroyed during their approach by the fire of "machine guns." By this term he means the larger class of machine guns, or "anti-torpedo boat guns." Of course, it is probable that any quick-firing guns available would also devote themselves to the same task; any hit made by their

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projectiles being much more effectual than that of the solid steel bullet of the machine gun.

Captain FitzGerald, R.N., read a paper on 'Side Armour *versus* Armoured Decks,' at the United Service Institution on January 21st, 1885. In this he dwelt particularly on the effect of *quick-firing guns*, urging "that in view of the recent development of light and machine gun fire, no iron ship is fit to go into action at all, or to be called a 'man-of-war,' which has not got a complete water-line belt of some sort of armour." Supposing that the Italia, with her four 100-ton guns and smaller armament, engaged the Hercules; he argued that, if the former did not sink the latter by the first discharge of her 100-ton guns, the Hercules, with light and machine guns, would put the Italia in a sinking condition before she could fire another round. Without endorsing the view here put forward, it may be used to furnish an illustration of the work primarily contemplated for quick-firing guns.

Invitation for Quick-firing Guns.

In 1881 it was decided by the War Department to invite inventors to supply a new gun for the light armament of our Navy, and the following memorandum of conditions to guide manufacturers was issued by the War Office, dated December 29, 1881.

1. The gun to be a breech-loader which will range with accuracy to 4000 yards.

2. The muzzle velocity of the projectile to be not less than 1800 f.s.

3. The projectile to be shell and steel shot of 6 lb. weight.

4. The projectiles and powder charges to be made up in one cartridge for simultaneous loading.

5. The service of the gun to be capable of being performed by three men.

6. The gun to be able to fire under the above conditions not less than twelve aimed rounds per minute.

7. The mounting to be suitable for either ship or boat service. An alternative mounting to be provided to enable the gun to be readily mounted for field service.

8. To be capable of readily delivering an all-round fire.

9. The recoil to be reduced to the lowest limits, and the gun to return after recoil to the firing position.

10. The gun to be provided with an easy removable shield, proof against the fire of the Martini-Henry rifle at 100 yards range.

11. The total weight of the gun and ship mounting not to exceed 10 cwt.

The only pieces that fulfilled these conditions were the *Nordenfelt* and *Hotchkiss* guns, which will therefore be described hereafter under the heading of Quick-firing Guns.

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The following pieces have been issued, including experimental arms:—

Machine Guns.

Gatling, 10 barrel, 0·45 in., and also 0·65-in. bore.
Gardner, 5, 2, and single-barrel arms all 0·45-in. bore.
Nordenfelt, 5 barrel, 0·45-in. bore.
Nordenfelt's anti-torpedo boat, gun 4 and 2 barrel, 1-in. bore.

Quick-firing Guns.

Nordenfelt, 6-pounder.
Hotchkiss, 6 and 3-pounder guns.

Cartridges for machine guns, 0·45-in. bore, "Mark II.," 1883, are in wrappers with a black triangular patch to catch the eye.

Cartridges for machine guns, 0·45 bore, with Martini-Henry chamber, "Mark I.," 1886, have a red oblong patch on the wrapper. Cartridges for Nordenfelt's 1·0-in. steel bullets, "Mark IV.," 1883, have a black diamond on the wrapper.

Gatling Gun.

The Gatling machine gun has been made with 6, 8 and 10 barrels. The barrels and locks revolve together inside an outer and stationary cylinder. The piece is shown in action in Figs. 1 and 2, Pl. XXVI. The locks have, during revolution, a forward and backward motion. The former places the cartridges in the chambers of the barrels, and closes the breech at each discharge, while the latter extracts the empty cartridge case after firing. The cartridges were formerly fed by the action of gravity on a single stream, which did not correspond in speed to the otherwise extremely rapid action of the arm, and therefore acted rather as a drag on it, in the earlier trials; including an important series at Shoeburyness in 1881. An improved system of feed has since been provided.

The cartridges are now supplied to the gun from magazines consisting of a circular drum of a width slightly greater than the length of the cartridge. On the two circular plates which form the ends of the drum are spiral grooves running from the centre to the outer edge, by which the ends of the cartridges are supported and guided in and out of the magazine, Fig. 3, Pl. XXVI. In the centre of the magazine between these grooved plates are two other circular plates which revolve round the centre shaft; they have a number of slots radiating from the centre, and are connected near the outer edge by pins (Fig. 4). The magazine is held in its place over the receiver by flanges on each side of the hopper, with two undercut slots in which two projections on the magazine fit, so as to lock it in its place. The slots are of unequal size, so that the magazine cannot

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be wrongly inserted. In firing at high elevations the cartridges are prevented from sliding back into the mechanism through the orifice in the front lock flange, either when the locks are in or out of the gun, by the openings being flanged and the lock being made to correspond. The gun has been fired in a vertical position with as much ease and certainty as when horizontal. The gun is mounted on trunnions 2 in. below the centre, and is elevated and depressed by means of a circular elevating arc connected at both extremities with the gun, and actuated by gearing so arranged that elevation and depression are indicated in degrees and minutes. A horizontal limb for direction is graduated in the same way. Both kinds of gear are so arranged that they can be instantly thrown out to allow the gun to be moved rapidly in all directions by means of a long handspike. The automatic oscillator is dispensed with, the effect being produced by hand movement of the handspike. An adjustment of the lateral training is obtained by means of stops on the turn-table of the carriage, which can be set to any required number of degrees. The adjustment of the vertical oscillation is obtained by means of stops in the elevating arc, which can be set to any number of degrees. The gun can be elevated to 74° and depressed to 78°. It is provided with two sights, one on each side. A device is added to serve the purpose of throwing the cocking ring out of action at will, and to prevent the cocking of the firing pins. This is of advantage during drill, and allows firing motion to take place without snapping, and thereby injuring the firing pins. The barrels are locked into the rear flange plate instead of being screwed as heretofore. In case of accident to any lock or barrel, the lock can be instantly removed and the firing continued with the remaining locks.

The gun can be fired with the crank either at the rear or side. When at the side, the gun fires at each turn of the crank, about one-half the number of shots to the number of barrels in the gun; when at the rear it fires at each turn of the crank, as many shots as there are barrels in the gun. The feed magazines hold from 65 to 104 cartridges each, and weigh from 10 lb. to 24½ lb. when full of cartridges. The musket-calibre guns weigh from 100 lb. to 237 lb. each, according to the number and length of the barrels.

Fig. 5, Pl. XXVI. is a side elevation of the gun. Fig. 6 is a longitudinal section through the axis. When the piece is fired at very high angles the bullets come down nearly perpendicularly with force sufficient to penetrate from 2 in. to 5 in. of timber.

The firing of the barrels of this piece being strictly successive, it has no recoil, and under favourable circumstances offers advantages

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GARDNER MACHINE GUN.

FIG. 1.

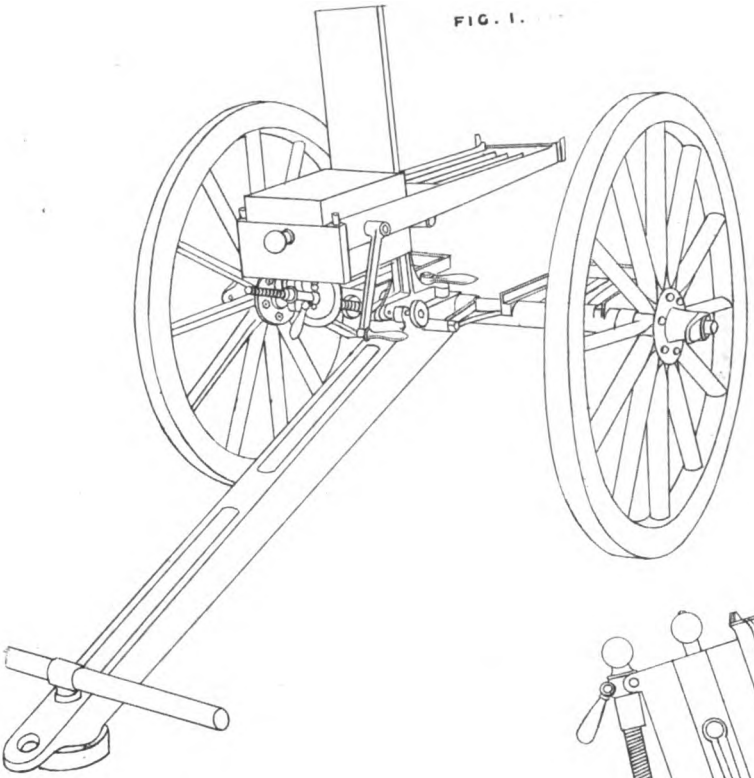


FIG. 3.

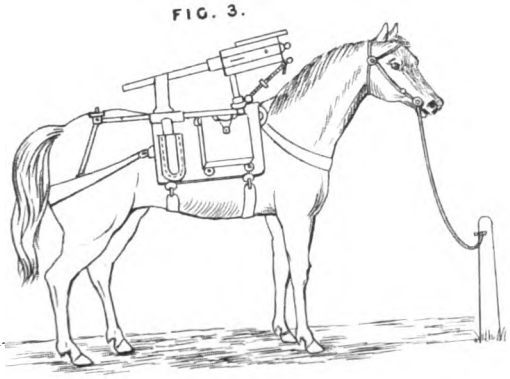
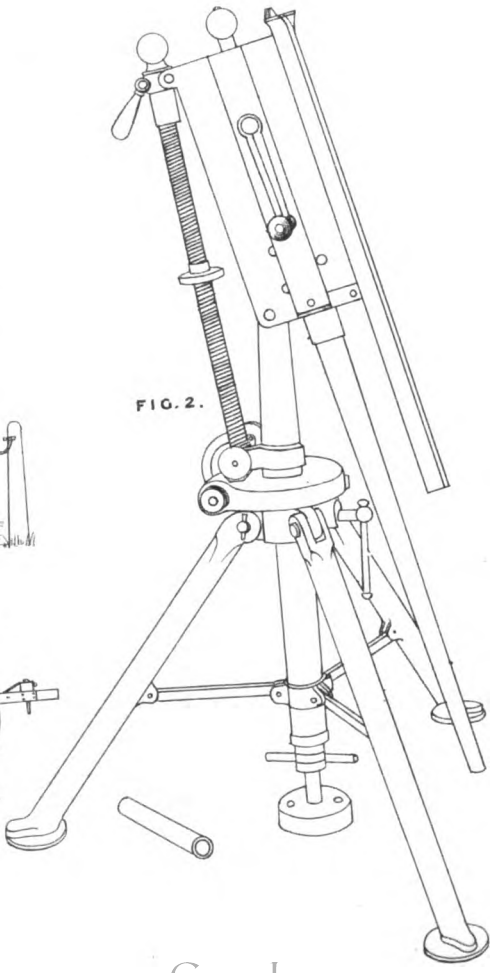


FIG. 2.



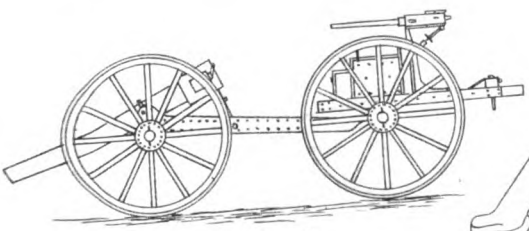


FIG. 4.

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MAXIM MACHINE GUN.

FIG. 2. PLAN. BREECH CLOSED. FIRING POSITION.

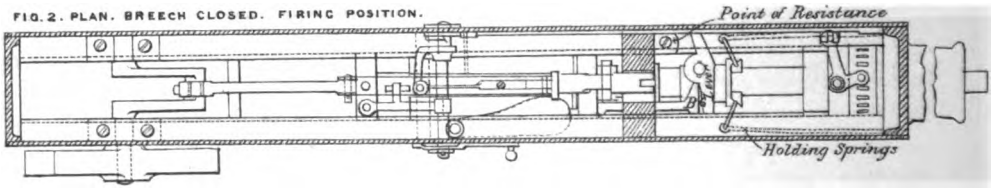


FIG. 3. VERTICAL SECTION. BREECH OPEN.

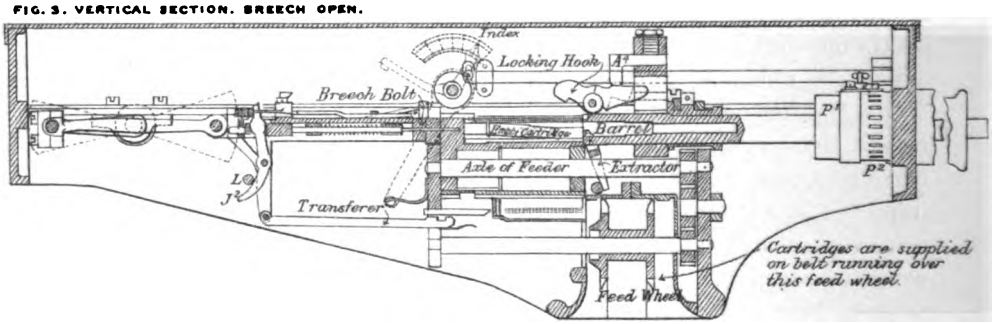


FIG. 4. PLAN. BREECH OPEN.

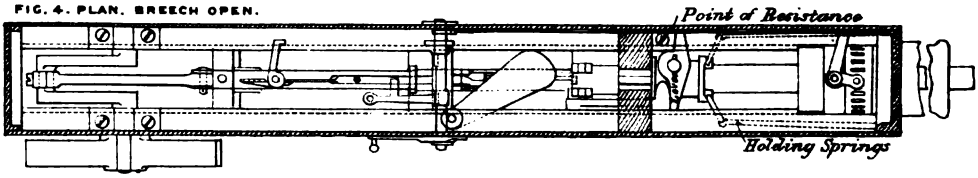
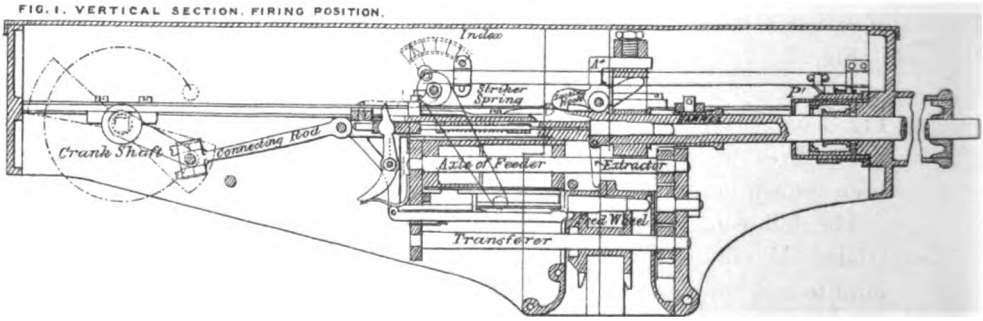


FIG. 1. VERTICAL SECTION. FIRING POSITION.



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in aiming, because a continuous stream of bullets sometimes admits of being brought to bear on an object by feeling the way up to it, in the way a fireman uses the hose of an engine.

The Gatling five-barrel is adapted for the service cartridge.

The following rates of firing have been realized in Government trials.

Gatling ten-barrel (with Accles improved feed): 1st drum, in 2·8 seconds. 2nd, in 2·6 seconds. 3rd, in 2·8 seconds. 4th and 5th each, in 2·6 seconds. These being fired at separate times, not in continuous succession. At Shoeburyness Mr. Accles has fired 1020 rounds in 1 min. 3 sec. The average rapidity in official trials for continuous firing was Gatling geared direct 330 rounds, and side action 326 rounds, per minute.

Gardner Gun.

The Gardner machine gun has figured in several forms. There has been a five-barrelled (Fig. 1, Pl. XXVII.), two-barrelled, and single-barrelled Gardner, besides a Gardner arm of early pattern, modified and improved by Pratt and Whitney. The Gardner action may be described generally as a simple and ingenious application of rotary motion to work two reciprocating actions alternately, in directions at right angles to each other, namely the advance and withdrawal of the lock, and the entrance and extraction of the cartridge. There are only two springs, the firing spring and one spiral spring. By a simple interchange of parts the firing of the barrels can be made either simultaneous or successive. The committee on machine guns in 1881 credited the Gardner with the following advantages: (1) Simplicity of mechanism; (2) Facility of removing and accessibility of parts; (3) Strength and endurance; (4) Rapidity of action; (5) Regular supply of ammunition; (6) Good extraction. The percentage of failures in firing the five-barrel Gardner at the trial was 0·04 or 4 in 10,000 rounds. The two-barrel Gardner had greater rapidity per weight of piece than any other, and it stood first in certainty of feeding and loading, in ease and regularity of fire, in general handiness, simplicity of action, strength, mobility, and freedom from jams.

Fig. 2, Pl. XXVII., shows the single-barrel Gardner on deck mounting, out of action. Fig. 3 shows it packed on horseback; and Fig. 4 on the limber of a gun carriage.

The five, two, and single-barrel Gardner, all of 0·45-in. bore, have been issued, but very few of the last-mentioned.

The following rates of firing have been realized in Government trials. Maximum, 330 rounds in 30 sec. For short periods 350 per minute is a fair rate. At Portland, in November, 1885, 1800 rounds were fired in ten minutes from the five-barrel arm.

The Gardner two-barrel has fired 6929 rounds without any jam,

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the last 3000 in 11 min. 39 sec., say 250 to 300 per minute for fair average rapidity.

Maxim Machine Gun.

The Maxim machine gun has not been officially tried as yet; it was brought forward so late that, to compete with those already established, it is necessary that it should show extraordinary powers. It was first known in this country in 1884, and attracted considerable attention. It is as yet untried by our Government.

The chief peculiarity is that the recoil of the barrel works the feeding and firing gear; the operator kneels down quietly behind the breech and directs the piece at his ease. The advantages claimed are as follows: (1) Much heavy manipulation is saved. (2) The danger of a jam from a heavy fire is obviated because the shock of discharge of each round loads and fires the succeeding one, consequently, however long a cartridge hangs fire, the motive power is not applied till it goes off, and no jam can occur from such delay. (3) An extraordinary rate of firing can be maintained, namely 600 rounds per minute from a single barrel. (4) The machine may be made lighter and need not be rigidly clamped, as must be the case when a lever is worked on one side of it.

The gun has a single barrel arranged in such a way as to recoil slightly in its bearings, the force of recoil acting on the feeding and firing gear, so as to load and discharge the next round, and so on, round after round, as long as cartridges are forthcoming. Thus the force of recoil extracts and ejects the empty case, brings the next round into position, pushes it home and cocks and liberates the striker. The barrel recoils $\frac{9}{16}$ of an inch with its breech held firmly closed. This gives the bullet time to escape and fly about 100 ft., so that the gases have also abundant time to escape after it has left the muzzle. Then a locking-hook, which has held it close, is opened, and the barrel is stopped, while the breech and extractor run on, carrying the empty case with them. This is ejected, and the succeeding round brought into position by a feed-wheel, when the return stroke, given by a connecting rod, sends the charge home, closing the breech, pushing the barrel forward into the firing position, and finally releasing the striker which fires the round. The recoil of this round repeats the above movements, and so on, as long as cartridges are supplied. The piece may be set to fire very slowly if required.

The bore is 0·45 in. The piece without stand weighs 60 lbs. A tripod stand for man-of-war weighs about 130 lbs., and a carriage for field service from 60 lbs. to 200 lbs. The piece may be left free for rapid change of aim by hand, or clamped and traversed by screws. The cartridges are fed from a drum or from belts, which may be joined on to each other so as to supply a stream of indefinite length.

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The barrel is enclosed in a case fitted with water to prevent overheating. There is a plan for carrying smoke away.

Many points require investigation, practically the chief matter of interest is the action. This is shown in the accompanying Figs. 1, 2, 3, and 4, Pl. XXVIII.

On firing, the barrel and breech bolt (see Figs. 1 and 3) with attachments, recoil firmly held together by the locking-hook, for about 0·44 in., then the counter lever of the latter comes in contact with the block A_4 (Figs. 1 and 3) causing the hook to rise and release the breech-bolt, which at the same time receives a sudden impetus from the lever (see Figs. 2 and 4) whose counter lever is brought in contact with the "point of resistance" (so called), causing the lever to act against B_6, and so drive back the breech-bolt and its attachments. It may be observed that this point of resistance moves along the curved face of A_5, changing each instant from a lever of greater power to one of greater speed; thus the momentum of the barrel is suddenly transferred to the breech-bolt and its attachments, which fly back with sufficient force to complete a revolution of the crank and connecting rod, bringing the breech-block back to the barrel and forcing both home into the firing position. In the meantime the extractor (Figs. 1 and 3) is made to eject the empty case of the fired cartridge (Fig. 3). The transferer at the same time draws a filled cartridge back from the feed-wheel, which is carrying round the belt full of cartridges, and leaves it in the feeder (Figs. 1 and 3). The feeder is made to revolve, bringing a filled cartridge round in the place of the empty one, in time to be carried forward by the advance of the breech-bolt. Also near the end of the withdrawal stroke, the counter lever J_2 of the lever J_1 J J_2 (Figs. 1 and 3) comes in contact with the stop L, which causes the lever end J_1 to carry back the striker and cock it.

Of course there are many pieces of mechanism not dealt with in this general explanation; for example, the arrangement for setting the gear for quick or slow firing, which depends on the opening or shutting off of the lever at the index and valves in a hydraulic cylinder (P_1 P_2 in Figs. 1 and 3), the gear for revolving the feed-wheel, and many minor details. The general character of the action may, however, be seen from the above. The adjustment of the levers and counter levers for speed or power, and the transferring of momentum is, perhaps, the neatest part of the design. The work would be greatly simplified if a special cartridge could be employed rendering the movement of the barrels unnecessary.

Nordenfelt Guns.

In the competitive trial in 1881, Nordenfelt had a 5-barrel and a 10-barrel of 0·45-in. bore gun. These, however, are by no means the

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most important representatives of his system, but the 4-barrel 1-in. bore which has long been in the service. The 10-barrel Nordenfelt, according to the Committee, had the greatest absolute speed of fire though not the greatest per weight of gun. It also stood first in facility of laying. Nordenfelt guns, however, are best known from results obtained in perforation of steel and iron plates, such as might be used on torpedo boats. The 4-barrel 1-in. gun above mentioned, which is shown in Fig. 1, Pl. XXIX. is termed by Nordenfelt an "Anti-Torpedo Boat Gun."

A Nordenfelt gun has its barrels placed horizontally in a row. This enables the feed to reach the whole of the barrels simultaneously. Movement is effected by means of a lever projecting to the right side of the breech end of the piece, which lever is worked backwards and forwards, the whole of the breeches being opened and the extractor loading and firing of each being performed simultaneously. In these respects the arm is the precise opposite of the Gatling. The inventor urges that the advantage of the to and fro motion is that it is more completely under command than the rotatory; that it moreover supports the cartridges better while undergoing discharge, for it gains time for each round, inasmuch as the simultaneous discharge gives to each round the entire time occupied by all, instead of only a fraction of it. He states that in successive action, mitrailleuse cartridges with powder still burning in them are liable to be ejected in numbers round the legs of the operator, when the powder, from damp or other cause, acts imperfectly. He also advocates volley firing as being the only method suitable for sea service, because the rolling of the ship, while it permits time to be taken for an instant volley discharge, does not suit a successive stream of single rounds. As compared with the Gatling, it may be seen that each system has its advantage, one in a rough, the other in a smooth sea. The to and fro motion is undoubtedly a tiring one to the operator.

The 4-barrel 1-in. gun was introduced into the Navy with a view to damaging the boiler of a torpedo boat at a distance of from 300 to 500 yds. Other essential conditions required were: (1) that the gun could be fired so rapidly that it would almost certainly score a sufficient number of hits on an approaching torpedo boat to ensure its being disabled during its run at full speed from the distance above named, before it could reach the vessel attacked; (2) that it could be fired so rapidly as to make it impossible for the boat to discharge a Whitehead torpedo at such a range that the missile would have any reasonable chance of hitting its mark.

After various competitions, the Admiralty decided in favour of the Nordenfelt gun for reasons given in an official Admiralty Report of

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NORDENFELT ONE INCH "ANTI-TORPEDO BOAT" MACHINE GUN.

FIG. 1.

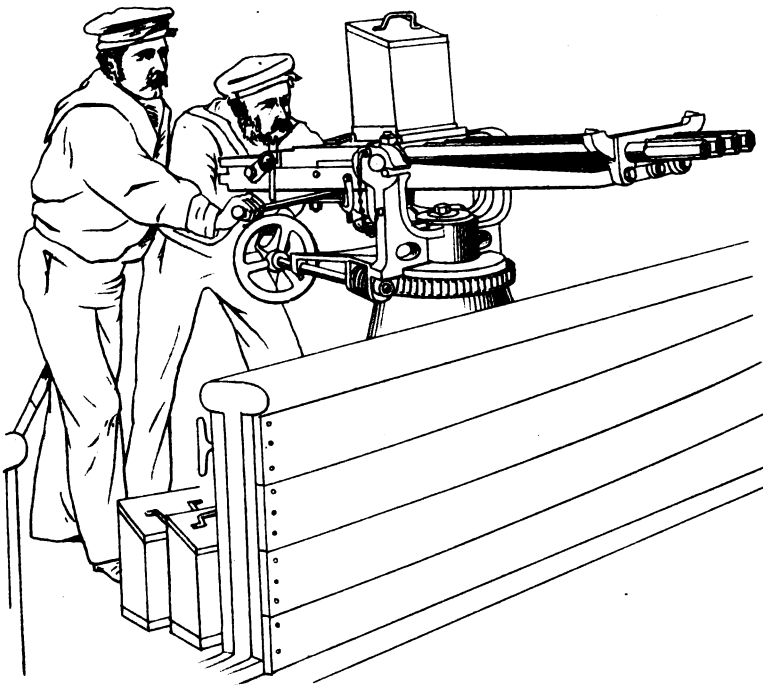
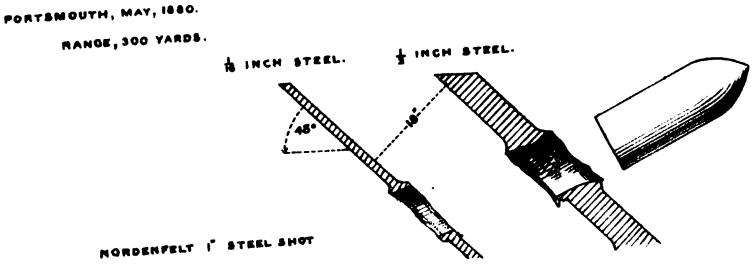
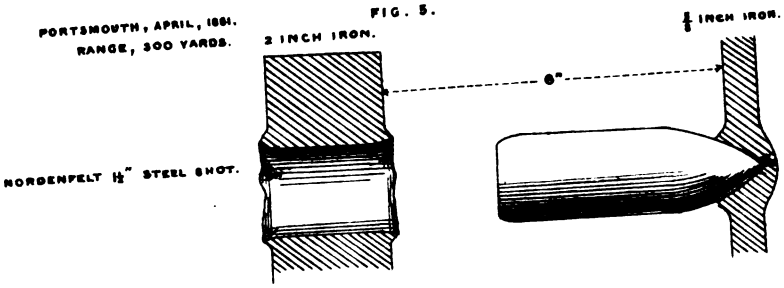


FIG. 2.



NORDENFELT SHELL GUNS.

FIG. 3.



HANHART LITH

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NORDENFELT ONE INCH "ANTI TORPEDO BOAT" MACHINE GUN.

NORDENFELT 1" GUN & THE HOTCHKISS 37 ⅝ GUN,

FIRED AGAINST TORPEDO BOAT MODELS.

PORTSMOUTH, MAY, 1880. RANGE, 300 YARDS

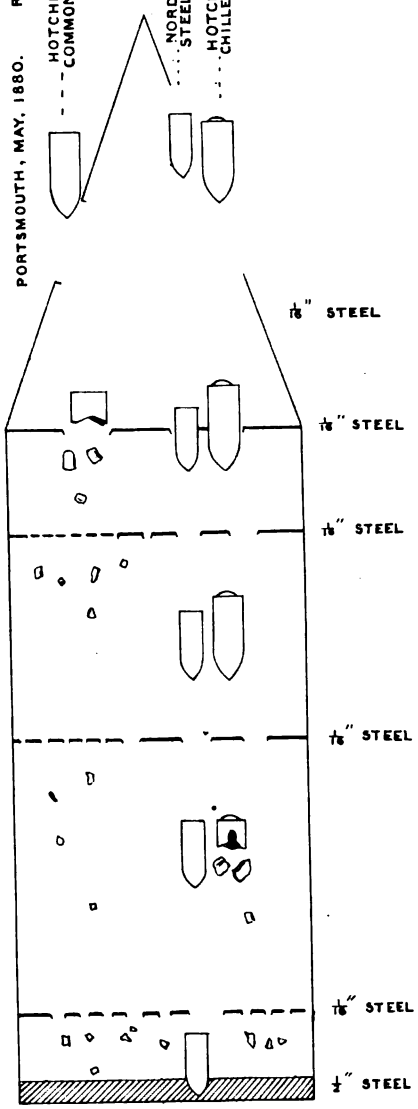
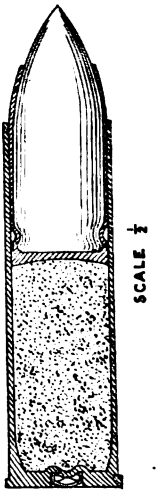


FIG. 3.

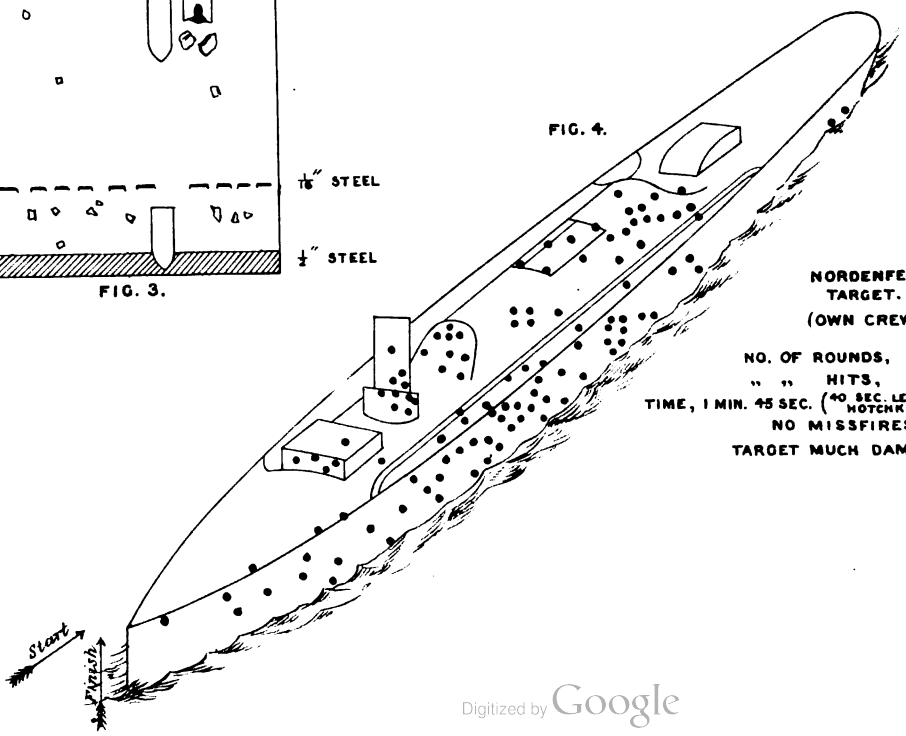
FIG. 6.



CARTRIDGE FOR THE NORDENFELT 1 INCH 4 BARRELLED ANTI TORPEDO BOAT GUN.

SCALE ½

FIG. 4.



NORDENFELT TARGET. (OWN CREW)

NO. OF ROUNDS, 135.
" " HITS, 115.
TIME, 1 MIN. 45 SEC. (40 SEC. LESS THAN HOTCHKISS.
NO MISSFIRES.
TARGET MUCH DAMAGED

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June 21, 1880. This report shows that (1) the penetrating power of the gun was proved to be sufficient, as the hardened steel bullet of 7¼ oz. weight, at a range of 300 yds., penetrated at an angle of 45 deg. the side and boiler of a torpedo boat, as represented by a $\frac{1}{16}$-in. steel plate, 18 in. in front of a second steel plate ½ in. thick (*vide* Fig. 2, Pl. XXIX.). When firing directly end on at a torpedo boat, the bullet penetrated the steel bow plate $\frac{1}{16}$ in. thick, at an angle of 10 deg., and four bulkheads at right angles; striking the boiler, the bullet then indented the ½-in. steel plate representing it, to a depth of half an inch (*vide* Fig. 3, Pl. XXX.). At a subsequent trial at Portsmouth, under similar conditions, the plate was perforated altogether.* (2) The accuracy was found most satisfactory, the mean deviation at 300 yds., of 10 rounds fired slowly, being 5·6 in., while the mean deviation of 24 rounds fired in rapid volleys was 18·3 in. (3) The rapidity of fire ashore at one trial was 108 shots in 30 seconds. During another the gun was fired at sea from H.M.S. Medway when running at a speed of 9 knots. In this case the target was the bow of a model torpedo boat; during a run of 1 min. 45 sec. and over a range of from 500 yds. to 100 yds., 115 hits were made out of 135 shots fired, equal to 65 hits per minute (*vide* Fig. 4, Pl. XXX.). In a subsequent trial at Spithead in July, 1880, the gun was placed on board H.M.S. Iris. On this occasion two runs were made at a speed of 17·2 knots, directly against the bow of a torpedo boat model. Firing from 700 yds. distance until close up, both runs occupying 2 min. 19 sec., 110 shots hit the target out of 213 rounds fired, so that even at this high speed 48 hits per minute were recorded. Running past the torpedo boat at 200 yds. range and at a speed of 17 knots, 58 rounds were fired in 22 sec., and of these, 38 shots hit the torpedo boat, being at the rate of 103 hits per minute.

The direct perforation is rather uncertain, and varies according to circumstances. Fig. 5, Pl. XXIX., shows the effect, not of an inch but of an inch and a half steel bullet at 300 yds. The striking velocity was 1508 ft., the weight of the shot 1·75 lbs. This gives a calculated perforation of nearly 3 in., which is rather better than the actual result. The rule of thumb (*vide* p. 325) would give little over 2¼ in., which is too small, but may furnish a rough idea. The actual result lies between the two estimates.

The only projectile fired by this gun is the steel bullet shown with

* The fact of the Hotchkiss chilled and common shell failing to perforate as well as the Nordenfelt steel bullet is due to inferiority in the projectiles rather than the system. Beyond the fact of the calibre adopted in proportion to weight, a system imposes no conditions as to projectiles.

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its cartridge in Fig. 6, Pl. XXX. The powder charge is 1·53 oz. The bullet weighs 7·2 oz. The case is solid drawn.

The Nordenfelt 4-barrel has fired about 150 to 200 rounds per minute. Under service conditions at Portland, in November, 1885, 400 rounds were fired in 10 minutes.

Nordenfelt Quick-firing Gun.

The 2·2-in. Nordenfelt gun discharges projectiles weighing 6 lbs. from a single barrel, and it comes distinctly under the head of a quick-firing gun. Its special function as compared with the inch calibre is to attack unarmoured parts of ships. Some British vessels carrying an armament consisting of a few very heavy guns, such as the Inflexible and Dreadnought types, specially need such guns to deal with the unarmoured batteries of an enemy. Experiments at Portsmouth with the first guns delivered showed satisfactorily that large ships' boats could bear the strain of firing and working a 6-pdr. 2·2-in. Nordenfelt.

A gun of this size differs from a machine gun in having a recoil which is sufficient to alter the direction of the barrel and necessitate laying afresh, thus rendering really quick fire impossible, unless special provision is made to meet this difficulty, in addition to the necessary appliances for rapid delivery of fire.

Fig. 3, Pl. XXXI., shows the gun mounted on a recoil carriage. Fig. 4 shows it in a boat. Without going into details, it may be said that, by means of the jointed frame-work, the gun recoils on a system producing parallel motion, and causing the lower end of a forked lever to act on the piston of a hydraulic and spring buffer. After recoil, the gun returns to the firing position without serious alteration in the laying. By this means a strong ship's boat may be enabled to bear the firing of the gun, and a rapid rate of fire may be effectually delivered. Without deliberate aiming, about 18 shots a minute is the maximum rate. At Portsmouth a gunnery officer actually fired three series of six shots each, in from 14 to 16 seconds for each set of six shots aiming roughly. As to perforation, which is of the highest importance against partly armoured or unarmoured war ships, at 300 yds. range, 4½ in. of iron and 3⅜ in. of steel have been perforated when struck directly. A 3-in. steel plate was perforated at 60°, also an inch steel plate struck at 15° with the face of the plate.

The breech mechanism is shown in Figs. 1 and 2, Pl. XXXI. In Fig. 1 the wedge is home, and in Fig. 2 it is released.

Figs. 5, 6, 7, and 8 show the ammunition. The weights of parts are as follows:—Gun, 5·5 cwt.; carriage (boat or ship), 4·4 cwt.; projectile, 6 lbs.; charge, 2·375 lbs.; bursting charge for chilled shell, steel shell, and common shell, 320 grs. and 4·2 oz. and 3·8 oz.

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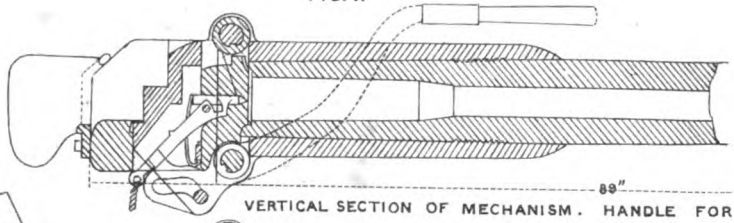
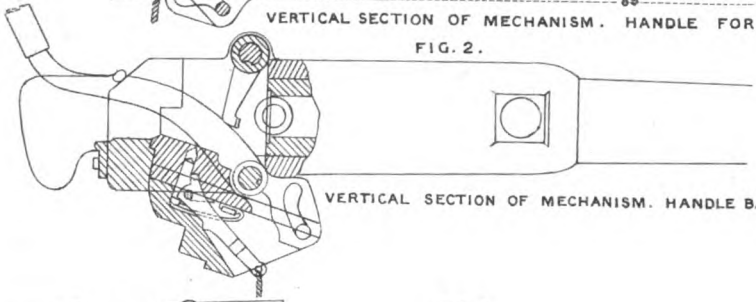
NORDENFELT QUICK FIRING GUN.

FIG. 1.



VERTICAL SECTION OF MECHANISM. HANDLE FORWARD.

FIG. 2.



VERTICAL SECTION OF MECHANISM. HANDLE BACK.

FIG. 3.

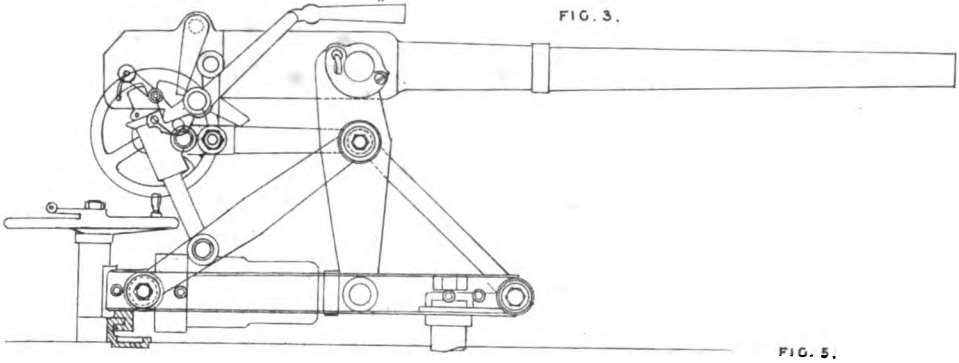


FIG. 4.

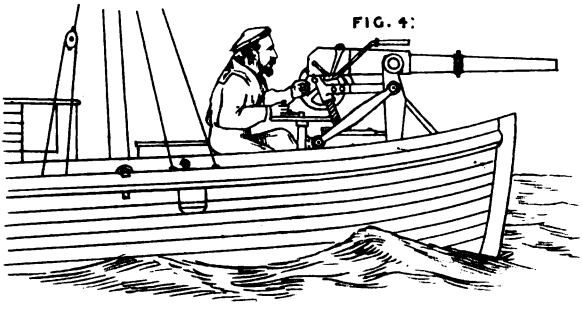


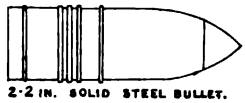
FIG. 5.

SCALE $\frac{1}{4}$

2·2 IN. CHILLED ARMOUR PIERCING SHELL.

FIG. 7.

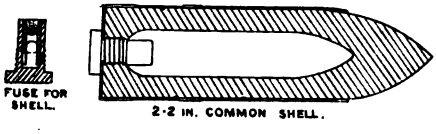
SCALE $\frac{1}{4}$



2·2 IN. SOLID STEEL BULLET.

FIG. 6.

SCALE $\frac{1}{4}$

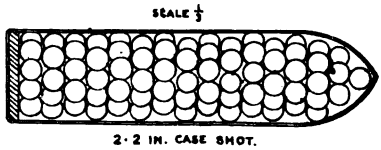


FUSE FOR SHELL.

2·2 IN. COMMON SHELL.

FIG. 8.

SCALE $\frac{1}{4}$



2·2 IN. CASE SHOT.

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HOTCHKISS QUICK FIRING GUN.

FIG. 1.

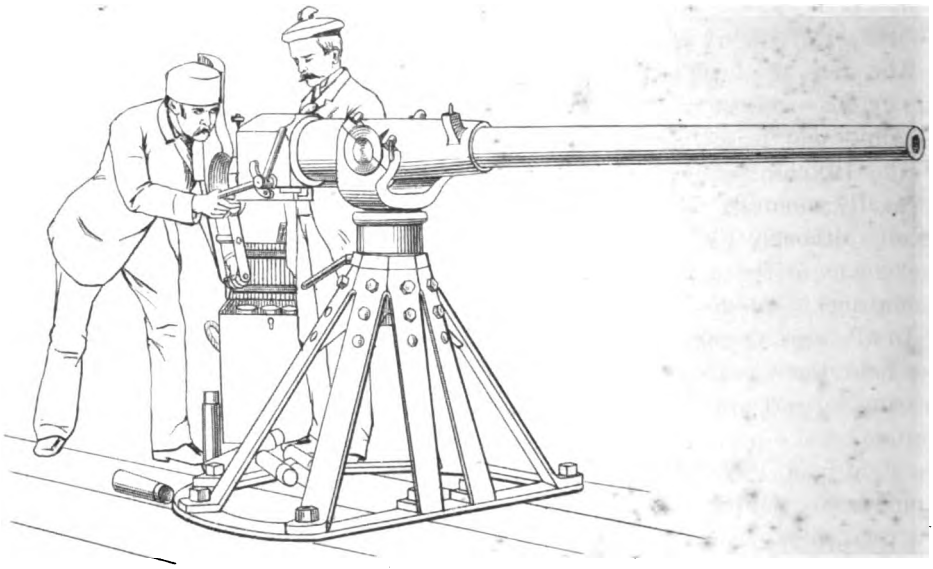


FIG. 2.

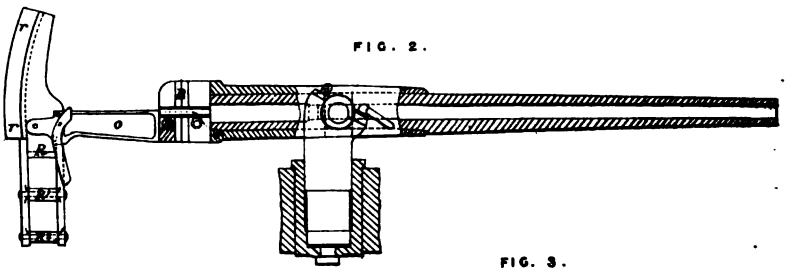


FIG. 3.

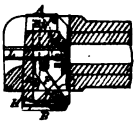


FIG. 4.

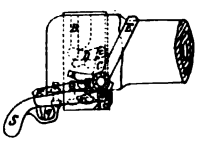
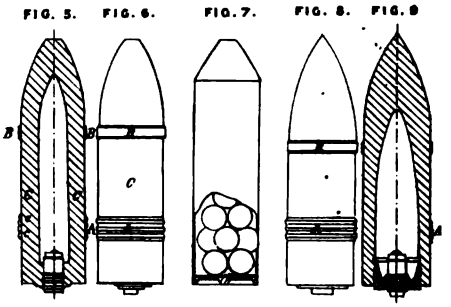


FIG. 5. FIG. 6. FIG. 7. FIG. 8. FIG. 9



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respectively; number of lead bullets in shrapnel, 49; muzzle velocity, 2010 ft. seconds, at 300 yds., 1807 f.s.; at 1000 yds., 1408 f.s.; at 4000 yds., 668 f.s.

The rate of firing of Nordenfelt's quick-firing gun is about 17 rounds per minute not aiming, or 12 per minute taking aim. This rate may be maintained without difficulty.

Hotchkiss Quick-firing Gun.

The Hotchkiss guns are called "non-recoil," because they are generally mounted on fixed elastic pivots and have no perceptible recoil, although the guns in reality have a definite amount of movement at the departure of the projectile, sufficient to relieve the mountings of undue shock.

In all cases, except for the larger calibres for boat service and for the field, these guns are laid by means of a stock, or shoulder-piece, bearing against the left shoulder (as in the Hotchkiss revolving cannon), and a pistol-grip with trigger, which the gunner grasps with his right hand. He fires the moment his sight bears upon the object aimed at, by pulling the trigger, so that it may be said that this gun has the general characteristics of the Hotchkiss mounting, viz.:—(1) The gun is mounted on a pivot and trained direct by the shoulder without the aid of any elevating or directing mechanism; thus enabling it to be pointed easily and rapidly from moving and rolling vessels against swiftly moving objects. (2) The sighting and firing are effected by a single man, which is shown in perspective in Fig. 1, Pl. XXXII.

The gun is made of Whitworth's fluid-pressed steel, oil tempered. The body consists of a tube, and a jacket carrying the breech and the trunnions, so that the longitudinal and transverse strains are divided. The jacket is shrunk over the tube, and, to prevent any slipping, they are locked together by a screwed collar, carrying the fore sight. The gun is exactly balanced in the trunnions. It is shown in longitudinal section in Fig. 2, Pl. XXXII.

Breech Action.—The breech action belongs to the class of guns with a breech-block sliding vertically through a mortice, and actuated by a lever, the movement of which opens the breech, extracts the fired cartridge case, and cocks the hammer for the next shot. The action is composed of the following parts, viz.:—The wedge, with its stop-screw for limiting the run; crank and crank-handle for moving the wedge up and down; firing-hammer and its rocking-shaft; mainspring, trigger sear, trigger-spring, and trigger, and the extractor (*vide* Figs. 2, 3, and 4).

A, Fig. 3, is a wedge, running in guides BB, with screw stop b. C is a crank with pin c in groove D with handle EE (Fig. 4). F is

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the hammer on rocking-shaft G with arm g. H is the trigger sear. I the v-shaped mainspring. L the extractor with stud l in groove M. N the opening in wedge. O (Fig. 2) is gun metal part of stock. R_1 R_2 and R_3. S (Fig. 4) is the pistol grip.

The gun is worked by two men, one to load and one to operate the breech action and fire. The rapidity of fire, with careful aiming, was found to be at Shoeburyness about 13 rounds per minute.

Three projectiles are used—viz., common shell, steel shell, and case shot (*vide* Figs. 5 and 6, Figs. 8 and 9, and Fig. 7 respectively).

Fig. 10 shows the percussion fuze. The plunger or hammer K by inertia grips the firing pin L as the latter moves forward. On impact both fly forward firing the detonator composition G. This fuze is screwed into the base of steel or common shell.

The features of the projectiles speak for themselves, the end of case shot is coned to facilitate rapid loading.

The principal weights and dimensions are as follows :—

PRINCIPAL WEIGHTS, DIMENSIONS, &c.

	Gun.		
Calibre		57 mm.	2·244 in.
Length of bore		2280 „	7 ft. 5·7 in.
Do. in calibres ...		40 „	
Rifling	Number of grooves	24	
	Width of lands ...	2 mm.	0·078 in.
	Depth of grooves ...	0·4 „	0·0157 „
	Twist, increasing 1 to 6 deg.		
Length of gun		2480 mm.	8 ft. 1·6 in.
Do. including stock		3000 „	9 ft. 10·1 in.
Weight of gun do. ...		370 kil.	7·03 cwt.
Weight of pivot		115 „	2·18 „
Weight of elastic pedestal ...		320 „	6·08 „
	Ammunition.		
Weight of common shell filled and fuzed ...		2·720 kil.	6 lb.
Bursting charge		85 grs.	2·97 oz.
Steel shell		2·720 kil.	6 lb.
Bursting charge		115 grs.	4·02 oz.
Case shot		3·400 kil.	7 lb. 7 oz.
Length of projectile		220 mm.	8·66 in.
„ of cartridge complete		481 „	22·9 in.
Weight of cartridge complete		4·23 kil.	9 lb. 5·2 oz.
Firing charge		850 grs.	29·75 oz.
Muzzle velocity		460 met.	1849 ft.
„ energy		43·48 met. tns.	140·4 ft. tns.
Thickness of iron perforated at muzzle about		114 mm.	4½ ins.

This gun, like the Nordenfelt, fires about 17 rounds per minute without aiming, 12 per minute aimed. This rate ought to be maintained without difficulty.

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NOTE ON TABLES OF BRITISH AND FOREIGN GUNS.

The greater part of the following Tables have been copied from the Austrian Marine Almanack for 1886. A few alterations and additions have been made, and the foreign measures have been converted into English. The perforations have all been recalculated, because most of those given in the above-mentioned work are considerably less than would be given on any system used in England, and would not be comparable with the English results. Moreover, a few obvious errors were detected, which could only be corrected by working out again. Hence the whole of the total energies, energies per inch circumference, and perforations, have been recalculated.

The British Table is a summary made by Major Mackinlay, R.A., from the large official Table of 1886, for his official Text Book of Gunnery.

The Table of United States Naval Ordnance has been obtained from Captain W. H. Bixby, U.S. Army, and Constructor F. Bowles, U.S. Navy.

The Table for conversion of foreign measures is one worked out by Major Mackinlay, R.A., for his official Text Book of Gunnery. The figures are taken from various sources, chiefly Colonel Noble's useful Tables.

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BRITISH RIFLED ORDNANCE.

(Chiefly founded on the official "List of Service Rifled Ordnance, 1886.")

Ordnance.												Charge (full).	Projectile.					Ballistics (with full charges).				
Nature.				Chamber.				Rifling.												Perforation of wrought iron.		
	Calibre or Pr.	Weight.	Mark and Service.	Length of bore, including chamber.	Diameter.	Length.	Capacity.	Twist one turn in: Least at breech.	Greatest at muzzle.	Distance at muzzle twist is uniform.	System.*	Weight.§	Diameter.	Weight.†	Value of $\frac{d^3}{w}$.	Value of $\frac{w}{d^2}$.	Muzzle velocity.	Total muzzle energy.	Muzzle energy per ton of gun.	At muzzle.	rds range.	At 2000 yards range.
				ins.	ins.	ins.	cub. ins.	cals.	cals.	ins.		lbs.	ins.	lbs. ozs.			f. s.	ft. tons.	ft. tons.	ins.	ins.	ins.
B.L. Guns (new type).	16·25-in.	110½ tons.	S.	..	..	..	..	..	..	..	P.	900 P.B.	16·25	1800 0	0·146	0·421	2216‡	61,190	553·7	36·4	35	—
	13·5-in.	67 tons.	II. S.	405·0	18·0	66·5	17,100	120	30	131·0	P.M.B.	520 P.B.	13·5	..	..	..	1960‡	—	—	—	—	—
	12-in.	45 tons.	II. IV. V. S.	301·6	16·0	49·0	9,780	120	35	124·5	P.M.B.	295 P.B.	12·0	714 0	0·202	0·413	1910	18,060	420·1	22·5	20·6	18·8
	10-in.	29 tons.	II.	251·3	14·0	54·0	8,370	120	30	166·7	P.M.B.	250 P.B.	10·0	..	..	..	2100‡	—	—	—	—	—
	9·2-in.	21 & 22 tns.	I. II. S.	250·8	12·0	43·8	5,000	120	35	76·1	P.M.B.	160 P.B.	9·2	380 0	..	..	1835	8,876	..	18·0	16·6	—
	9·2-in.	22 tons.	III. IV. V. S.	261·3	12·0	43·8	5,000	120	30	120·4	P.M.B.	175 P.B.	9·2	380 0	0·238	0·477	2065	11,240	511·1	20·3	18·8	17·2
	8-in.	14 tons.	VI. S.	236·8	10·5	38·0	3,353	120	35	96·1	P.M.B.	125 P.B.	8·0	210 0	0·305	0·410	2200‡	7,048	508·2	17·4	15·6	13·5
	6-in.	5 ton.	V. S. L.	163·8	8·0	31.5	1,500	0	30	6·25	P.M.B.	42 P.²	6·0	100·0	0·360	0·433	1920	2556	511·2	12·1	10·3	8·7
	5-in.	40 cwt.	III. S.	125·3	5·75	19·3	510	120	25	51·8	P.M.B.	16 S.P.	5·0	50 0	0·500	0·400	1780	1,098	549·0	8·6	6·8	5·4
	4-in.	25 cwt.	IV. S.	108·0	5·3	18·5	417	120	30	43·77	P.M.B.	12 S.P.	4·0	25 0	0·640	0·391	1900	626·1	500·8	7·3	5·7	4·5
	4-in.	13 cwt.	I. S.	59·2	4·5	8·12	126·5	116	35	11·39	P.M.B.	3½ R.L.G.	4·0	25 0	0·640	0·391	1100	241·8	320·4	..	3·4	3·0
	12-pr.	7 cwt.	I. L.	84·4	3·625	11·2	118	120	28	35·8	P.M.B.	4 S.P.	3·0	12 5	0·720	0·463	1710	253·5	724·3	—	—	—
M.L. Guns.	17·72-in.	100 tons.	I. L.	363·0	19·7	59·72	16,957	150	50	2·88	P.M.M.	450 P.B.	17·72	1968 0	0·159	0·374	1548	32,710	327·1	24·5	23·2	21·4
	16-in.	80 tons.	I. S. & L.	288·0	18·0	59·6	14,600	0	50	0	P.M.M.	450 P.B.	16·0	1684 0	0·152	0·411	1590	29,530	369·1	24·7	23·1	21·3
	12·5-in.	38 tons.	II. S. & L.	198·0	14·0	41·125	6,000	438	35	0	W.	210 P²	12·5	809 6	0·193	0·415	1575	13,930	366·5	18·4	17·5	15·9
	12-in.	35 tons.	I. S. & L.	162·5	Unchambered			0	35	0	W.	140 P²	12·0	706 12	0·204	0·409	1390	9,469	250·5	15·9	14·4	13·1
	12-in.	25 tons.	II. S. & L.	145·0	„			100	50	0	W.	85 P²	12·0	608 6	0·237	0·352	1292	7,046	281·8	13·5	12·6	11·4
	11-in.	25 tons.	II. S. & L.	133·0	„			0	35	0	W.	85 P	11·0	543 2	0·223	0·408	1360	7,015	280·6	14·3	12·8	11·5
	10-in.	18 tons.	II. S & L.	145·5	„			100	40	0	W.	70 P	10·0	406 0	0·246	0·406	1379	5,356	297·5	12·9	11·6	10·4

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M.L. Guns.	9-in.	12 tons.	V. S. & L.	125·0	Unchambered.				0	45	0	W.	50 P.	9·0	253	5	0·320	0·347	1440	3,643	303·6	11·3	9·6	8·4				
	8-in.	9 tons.	III. S.	118·0	,,				0	40	0	W.	35 P.	7·92	174	12	0·359	0·352	1384	2,323	258·1	9·6	8·1	7·0				
	7-in.	90 cwt.	I. S.	110·0	,,				35	35	All	W.	22 P.	6·92	112	1	0·427	0·338	1325	1,400	..	..	6·5	5·6				
	7-in.	6½ tons.	III. S. & L.	111·0	,,				35	35	All	W.	30 P.	6·92	112	1	..	..	1525	1,854	..	..	7·5	6·1				
	7-in.	7 tons.	IV. L.	126·0	,,				35	35	All	W.	30 P.	6·92	112	1	0·427	0·338	1561	1,943	270·6	9·5	7·7	6·4				
	6·6-in.	70 cwt.	I. L.	97·5	6·8	21·0	709		100	35	13·2	P.M.M.	25 P.	6·6	97	12	0·446	0·340	1416	1,358	388·1	—	—	—				
	64-pr.	64 cwt.	I. II. S & L.	98·0	Unchambered.				40	40	All	Pl.	6 R.L.G.	6·28	67	2	0·588	0·271	1125	570	—	—	—	—				
	64-pr.	64 cwt.	III. S. & L.	97·5	,,				40	40	All	Pl.	8 R.L.G.	6·28	67	2	0·588	0·271	1260	700	231·3	—	—	—				
	40-pr.	35 cwt.	II. L.	104·5	,,				35	35	All	W.	7 R.L.G	4·75	40	14	0·552	0·382	1425	576	329·4	—	—	—				
	25-pr.	18 cwt.	I. L.	98·0	,,				35	35	All	W.	4 R.L.G.	3·94	25	7	0·605	0·420	1340	320	356·0	—	—	—				
	16-pr.	12 cwt.	I. L.	68·4	,,				30	30	All	F.M.	3 R.L.G.	3·54	16	4	0·771	0·366	1355	207	344·7	—	—	—				
	13-pr.	8 cwt.	I. L.	84·0	3·15	14·13	109		100	30	9·0	P.M.M.	3⅛ R.L.G.	3·0	13	1	0·689	0·484	1560	220	540·8	—	—	—				
	9-pr.	6 cwt.	II.III.S.&L.	66·0	Unchambered.				30	30	All	F.M.	1⅜ R.L.G.	2·94	9	2	0·946	0·359	1390	122	407·6	—	—	—				
	2·5-in.	400 lbs.	I. L.	66·5	2·56	11·07	54		80	30	3·53	P.M.M.	1½ R.L.G.	2·5	7	0	0·893	0·448	1440	96	538·4	—	—	—				
	7-pr.	200 lbs.	IV. S. & L.	36·0	Unchambered.				20	20	All	F.	¾ R.L.G.	2·94	7	5	1·181	0·288	950	46	513·1	—	—	—				
R.B.L. guns (screw).	7-in.	82 cwt.	S. & L.	99·58	7·2	16·0	620·0		37	37	All	P.	11 L.G.	7·0	109	0	0·450	0·318	1100	915	223·1	—	—	—				
	40-pr.	35 cwt.	S. & L.	106·3	4·96	13·5	257·8		36½	36½	All	P.	5 L.G.	4·75	40	2	0·562	0·374	1180	388	221·4	—	—	—				
	20-pr.	16 cwt.	L.	84·0	3·94	12·0	143·0		38	38	All	P.	2½ L.G.	3·75	21	13	0·645	0·414	1130	193	241·5	—	—	—				
		15&13cwt.	S.	54·1	3·94	11·0	131·0		38	38	All	P.	2½ L.G.	3·75	21	13	0·645	0·414	1000	156	—	—	—	—				
	12-pr.	8 cwt.	S. & L.	61·38	3·2	8·5	66·0		38	38	All	P.	1½ L.G.	3·0	11	4	0·800	0·417	1239	118	294·5	—	—	—				
	9-pr.	6 cwt.	S. & L.	52·5	3·2	7·0	55·1		38	38	All	P.	1½ L.G.	3·0	8	8	1·059	0·315	1055	66	218·8	—	—	—				
Quick Firing Guns.																									Mild steel plate.				
Hotchkiss .	6-pr.	8 cwt.	S.	..	..	..	..		..	..	..	..	1 15¼	2·25	6	0	0·844	0·527	1820	137·8	344·5	3·2	2·0	—				
Nordenfelt .	6-pr.	6 cwt.	S.	..	..	..	..		0	26	0	..	2 2	2·25	6	0	0·844	0·527	1860	143.9	479·6	3·3	2·1	—				
Hotchkiss .	3-pr.	4 cwt.	S.	..	..	..	..		25	25	All	..	1 1⅔	1·85	3	8	0·978	0·553	2000	97·1	485·5	2·9	1·8	—				
Machine Guns.													grains.		oz.	grs.								¾-in. at 200 yards.				
Nordenfelt, 4 bar.	1-in.	447 lbs.	III. S.	35·48	..	..	..		35	35	All	H.	625	1·0	7¼	0	2·207	0·453	..	..	..	..		Not known.				
Gatling, 10 bar.	0·65-in.	787 lbs.	S. & L.	33·0	..	..	..		46·5	46·5	All	H.	270	0·65	0	1425	2·109	0·730	..	..	..	..		Same as MH. bullet.				
Gardner, 2 bar .	0·45-in.	131 lbs.	S. & L.	30·0	..	..	..		48·9	48·9	All	H.	85	0·450		480	2·952	0·751	..	..	..	..						

S., Sea-service gun; L., Land-service. The Roman numeral is the number of the pattern given. H., Henry. † For the higher natures the weight of projectile given is for Palliser shot; for the lower natures it is for filled common shell. ‡ Estimated. § P B. (in column for charge) stands for Prismatic Brown; P., Pebble; R.L.G., Rifle Large Grain; L.G., Large Grain.

* P means Polygroove; M.M., Maitland muzzle-loading, and M.B., Maitland breech-loading; Pl., Plain; W., Woolwich; F., French; F.M., French modified; H., Henry.

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AUSTRIAN NAVAL ORDNANCE.

	Krupp Steel B.L. Guns.										Armstrong.		Uchatius.			
Designation by Calibre, in centimètres	30·5	28	26	24	24	21	15	15	15	12	23	18	15	9	7	15
Calibre, in inches	12·01	11·02	10·24	9·27	9·27	8·24	5·87	5·87	5·87	4·72	9·00	7·00	5·87	3·43	2·60	5·87
Length — Total, in Feet	35·11	20·01	18·77	17·16	15·45	13·73	17·13	12·63	12·63	..	13·00	10·83	12·19	6·76	3·28	10·13
Length — Rifled Portion, in inches	314·8	169·8	148·4	135·9	115·3	105·0	149·6	105·7	111·6	..	104·0	85·5	111·4	57·5	23·8	89·8
Length — Powder Chamber „	69·9	37·4	46·1	41·7	41·7	37·0	35·4	29·3	23·4	..	21·0	18·7	23·6	16·5	11·0	18·0
Length — Of bore in calibres	32·0	18·8	19·0	19·2	16·9	17·2	31·5	23·0	23·0	32·0	13·9	14·9	23·0	21·6	13·4	18·4
No. of Grooves	68	64	32	32	32	30	36	24	36	32	6	3	36	24	18	30
Twist in calibres	..	45	70	70	64·7	59	25	68·4	45	25	45	35	45	45	30	63·2
Weight — Gun, including Breech Gear, tons	47·8	27·1	21·7	14·6	14·5	8·68	4·69	3·94	3·94	2·25	12·50	6·50	3·35	0·479	0·09	2·81
Weight — Breech Block, in lbs.	..	2315	1951	1411	1422	1080	..	321·9	321·9	..	..	..	209·4	55·1	18·7	176·4
Weight — Steel Shell, in lbs.	1003·1	557·8	395·7	292·1	292·1	206·6	86·0	72·8	84·9	57·3	..	..	84·9	—	—	—
Weight — Chilled Shell „	..	..	..	..	308·6	196·2	..	..	..	..	255·7	117·7	—	—	—	—
Weight — Common Shell „	..	488·3	354·2	263·5	263·5	172·0	69·9	$\frac{67·2}{65·5}$	69·4	57·3	264·6	123·0	69·45	$\frac{14·02}{14·22}$	6·42	6·11
Weight — Shrapnel Shell „	..	..	..	..	..	..	71·9	$\frac{67·2}{65·5}$	69·4	57·3	..	..	69·45	15·76	6·88	6·79
Weight — Case Shot „	..	..	..	..	..	..	..	..	..	..	..	..	..	16·53	6·94	38·4
Weight of Bursting Charge — Steel Shell „	..	14·3	8·8	6·6	6·6	4·4	1·76	1·65	2·09	0·55	..	..	2·09	—	—	—
Weight of Bursting Charge — Chilled Shell „	..	..	..	..	3·75	..	..	..	..	..	5·95	1·23	—	—	—	—
Weight of Bursting Charge — Common Shell „	..	18·7	20·3	15·0	15·0	15·0	3.86	3·86	5·07	3·53	18·5	7·94	5·07	0·46	0·18	1·87
Weight of Bursting Charge — Shrapnel Shell „	..	..	..	..	..	..	1·10	1·08	1·08	0·57	..	..	1·08	0·20	0·09	0·90
Weight of Firing Charge — Steel and Chilled Projectile, in lbs.	..	123·5*	70·5	52·9	52·9	50·7 C	38·8	21·6 C	20·9 C	19·8	50·7 P	28·7 P	20·9 C	—	—	—
Weight of Firing Charge — Common „ „ „	..	123·5*	59·5	44·1	44·1	30·9	38·8	$\frac{14·3}{21·6}$	20·9 C	19·8	30·9 O	13·2 O	20·9 C	$\frac{3·31}{0·97}$	$\frac{0·77\ O}{0·35}$	4·74
Weight of Firing Charge — Exercising „ „ „	..	68·3	59·5	44·1	44·1	30·9	19·6	21·6 C	20·9 C	..	30·9 O	13·2 O	20·9 C	3·31	$\frac{0·77\ O}{0·35}$	4·74
Weight of Firing Charge — Saluting „ „ „	..	19·8 O	19·8 O	15·4 O	15·4 O	8·82 O	4·74 O	4·74 O	4·74 O	..	15·4 O	8·8 O	4·74 O	0·88 O	0·35	4·74
Muzzle Velocity, in feet	..	1568	1404	1421	$\frac{1378}{1345}$	1519	1969	1641	1562	1738	1490	1522	1562	1470	978	1017
Muzzle Energy — Total, foot-tons	..	9513	5409	4087	3847	3306	2312	1358	1435	1201	3933	1891	1435	—	—	—
Muzzle Energy — Per inch circumference, foot-tons	..	270·4	168·2	140·4	132·1	127·7	125·4	73·7	77·9	81·0	140·4	87·0	77·9	—	—	—
Thickness of Iron, perforated inches at Muzzle	..	17·0	13·2	12·1	11·7	11·6	11·7	8·8	9·1	9·4	12·2	9·6	9·1	—	—	—

NOTE.—P stands for pebble powder; C for cube powder; * prismatic powder; O ordinary powder (inferior).

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DANISH NAVAL ORDNANCE.

	Krupp B.L. Guns designated.						Armstrong M.L.			Finspong.		Bronze.	Cast Iron.
Designation by Calibre	35·5 cm.	30·5 cm.	26 cm.	15 cm.	12 cm.	8·6 cm.	10 in.	9 in.	8 in.	6 in.	5·5 in.	5 in.	3 in.
Calibre, in inches	13·98	12·01	10·24	5·91	4·72	3·43	10·01	9·39	7·98	6·04	5·54	5·02	3·28
Total length, in feet	29·1	22·0	18·77	12·63	9·6	6·9	16·8	13·0	10·8	9·5	9·2	9·6	5·5
Length of Bore, including Powder Chamber — in inches	304·7	227·2	194·5	135·0	102·4	73·6	175·5	125·0	104·2	100·8	94·1	100·7	57·4
Length of Bore, including Powder Chamber — in calibres	21·8	18·9	19·0	22·8	21·7	21·3	17·5	13·3	13·1	16·7	17·0	20·1	17·5
Number of Grooves	80	68	60	36	32	24	7	6	6	6	3	6	6
Twist of Rifling, in calibres	45	45	45	45	40	45	45	40	50	40	29	25	30
Total weight, including Breech-gear, tons	51·2	35·4	21·5	3·9	1·38	0·49	20·0	12·5	8·66	2·46	2·21	4·38	0·44
Weight of — Breech Block, lbs.	..	2910	1940	330·7	176·4	101·4	—	—	—	—	—	—	—
Weight of — Steel Shell, „	1157·4	725·3	451·9	—	—	—	—	—	—	—	—	—	—
Weight of — Chilled Shell, „	1157·4	725·3	451·9	86·0	44·1	—	402·3	250·2	165·3	—	—	—	—
Weight of — Common Shell, „	978·9	621·7	391·3	69·4	36·2	14·9	402·3	250·2	132·3	55·1	38·6	29·8	10·4
Weight of — Shrapnel Shell, „	..	..	..	..	..	..	..	..	149·9	—	—	—	—
Weight of — Case Shot, „	..	..	..	..	..	..	191·8	154·3	127·9	58·4	26·5	..	9·9
Weight of Bursting Charge — Steel Shell, „	27·8	18·5	11·5	..	..	..	—	—	—	—	—	—	—
Weight of Bursting Charge — Chilled Shell, „	15·0	9·9	6·0	1·1	0·55	..	4·4	—	—	—	—	—	—
Weight of Bursting Charge — Common Shell, „	51·6	32·6	20·9	5·1	2·4	0·44	24·3	16·5	6·6	4·2	2·2	1·8	0·44
Weight of Firing Charge — Steel or Chilled Shell, lbs.	253·5	158·7	99·2	18·7	8·8	..	69·4	43·0	29·8	—	—	—	—
Weight of Firing Charge — Common Shell, „	253·5	158·7	99·2	18·7	8·8	3·3	69·4	34·2	19·8	60·6	4·4	2·6	1·7
Muzzle Velocity — Armour-piercing Projectile, feet	1640	1558	1558	1562	1493	..	1388	1339	1378	—	—	—	—
Muzzle Velocity — Common Shell, „	1772	1673	1673	1683	1624	1457	1388	1220	1230	1076	1076	1030	1214
Muzzle Energy — Total foot-tons	21580	12200	7605	1455	6817	..	5376	3105	2177	—	—	—	—
Muzzle Energy — Per inch circumference, foot tons	491·2	323·5	236·4	78·4	46·0	..	171·0	105·2	86·9	—	—	—	—
Perforation at Muzzle, in inches	22·9	18 56	15·86	9·1	7·0	..	13·3	10·4	9·5	—	—	—	—

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DUTCH NAVAL ORDNANCE.

	Krupp Breech Loading.				Armstrong Muzzle Loading.			Dutch Breech Loading.		
Designation by Calibre, in centimètres	28	17	15	12 No. 1.	28	23	18	12 No. 2.	12 No. 3.	7·5
Calibre, in inches	11·02	6·80	5·87	4·72	11·00	9·00	7·00	4·72	4·72	2·95
Total Length, in feet	20·01	13·94	12·63	6·89	14·42	13·00	11·00	6·89	6·89	7·87
Length of Rifled Portion of bore, in inches	170·8	112·7	111·8	61·4	119·0	104·0	95·5	61·4	61·4	43·2
Length of Powder Chamber „	36·4	36·0	23·2	13·0	26·0	21·9	15·5	13·0	13·0	6·7
Length of bore, in Calibres	18·8	21·9	23·0	15·8	12·1	14·0	15·9	15·8	15·8	17·5
Number of Grooves	64	42	36	12	9	6	3	12		20
Depth of Grooves, inches	0·069	0·118	0·118	0·492	2·000	1·80	1·80	0·118		0·049
Total Weight, in tons	27·21	5·51	3·94	0·79	24·46	12·50	7·17	0·93	0·90	0·21
Firing Charge — Armour Piercing Projectile, in lbs.	121·3	27·6	20·9	..	86·0	50·7	30·0			—
Firing Charge — Common Shell „	121·3	27·6	20·9	2·43	86·0	50·7	13·9	2·43		0·82
Weight. — Armour-piercing Projectile „	560·0	132·3	86·0	41·0	533·5	249·1	114·6	—		—
Weight. — Common Shell „	476·2	112·4	69·4	29·5	535·7	262·4	116·8	29·5		9·5
Weight. — Case Shot „	273·4	63·9	41·9	26·5	185·2	149·9	68·3	26·5		9·3
Bursting Charge — Armour-piercing Projectile „	6·6	2·2	1·1	0·44	4·4	2·2	2·2	—		—
Bursting Charge — Common Shell „	26·5	6·6	6·6	2·0	28·7	17·6	8·8	1·8		0·44
Muzzle Velocity, feet	1558	1558	1558	971	1332	1476	1558	951		958
Muzzle Energy — Total, in foot-tons	9423	2226	1447	..	6563	3763	1929	—		—
Muzzle Energy — Per inch Circumference, foot-tons	272	104	84	..	191	134	89	—		—
Penetration at Muzzle, in inches	17·0	10·5	9·1	..	14·0	11·9	9·7	—		—

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FRENCH NAVAL ORDNANCE.

	Pattern 1875.	Pattern 1884.	Pattern 1881.*	Pattern 1875, and 1875 jacketed.						Pattern 1870, and 1870 jacketed.						Pattern 1870, and 1870 jacketed.					Pattern 1864–66, Coast Artillery.				
Desig. by Calibre, in cms.	42	37	34 short.	34	27 jack'd.	27 I.	27 II.	10 jack'd.	10	32 jack'd.	32	27 jack'd.	27	24 jack'd.	24	19 jack'd.	19	16	14 jack'd.	14	27	24	19	9·0	6·5
Calibre, in inches	16·54	14·66	13·38	13·4	10·8	10·8	10·8	3·94	3·94	12·6	12·6	10·8	10·8	9·45	9·45	7·64	7·64	6·49	5·46	5·46	10·8	9·45	7·64	3·54	2·57
Total length, in feet	30·2	..	..	22·0	19·3	19·3	19·3	9·26	9·26	22·0	22·0	17·7	17·7	16·2	16·2	13·6	13·6	12·2	10·3	10·4	15·1	15·0	12·5	7·12	3·58
Length of Bore, in inches	..	..	..	241·5	213·4	213·4	213·6	104·3	104·3	243·6	243·6	194·3	194·3	179·1	179·1	151·0	151·0	137·3	115·0	115·0	166·9	165·2	138·0	78·0	38·4
Length of Bore, in calibres	..	..	..	18·0	19·8	19·8	19·8	26·5	26·5	19·5	19·5	18·0	18·0	19·0	19·0	19·8	19·8	21·2	21·1	21·1	15·5	17·5	18·1	22·0	15·0
Number of Grooves	..	..	..	68	54	54	42	20	20	64	64	54	54	48	48	38	28	50	28	28	5	5	3	36	26
Depth of Grooves	..	..	0·059	0·059	0·059	0·059	0·059	0·032	0·032	0·059	0·059	0·059	0·059	0·059	0·059	0·059	0·059	0·039	0·047	0·047	0·252	0·252	0·217	0·031	0·031
Rifling Twist	..	..	..	4°	4°	4°	4°	7°	7°	4°	4°	4°	4°	4°	4°	4°	4°	7°	4°	4°	..	..	..	7°	8°
Total weight, in tons	75·8	71	51·8	47·58	27·85	27·36	24·11	1·24	1·18	38·38	38·38	22·83	22·84	15·41	15·41	7·83	7·83	4·98	2·63	2·66	20·18	14·27	7·87	0·59	0·094
Weight of Firing Charge — Armour piercing projectile, lbs.	..	546	357·1	257·9	165·3	136·7	103·6	..	..	189·6	152·1	136·7	92·6	101·4	61·7	60·4	33·1	39·7	..	..	79·4	52·9	27·6	—	—
Weight of Firing Charge — Common Shell „	..	..	..	231·5	145·5	121·3	103·6	10·1	7·1	172·0	152·1	126·8	92·6	92·6	61·7	..	33·1	39·7	13·6	9·0	52·9	35·3	17·6	3·62	0·90
Weight — Armour Piercing Projectile, lbs.	1719·6	1180	925·9	925·9	476·2	476·2	476·2	..	..	760·6	760·6	476·2	476·2	317·5	317·5	165·3	165·3	99·2	..	..	476·2	317·5	165·3	—	—
Weight — Common Shell „	..	..	..	771·6	396·8	396·8	396·8	30·9	26·5	631·6	631·6	396·8	396·8	264·6	264·6	137·8	136·7	99·2	61·7	61·7	317·5	220·5	115·2	17·6	5·95
Weight — Case Shot „	..	..	..	..	321·9	321·9	321·9	18·7	18·7	..	..	321·9	321·9	220·5	211·6	105·8	105·8	68·3	42·8	39·7	321·9	220·5	105·8	17·0	6·39
Muzzle Velocity, in feet, sec.	1739	1955	..	1595	1736	1641	1542	1673	1591	1542	1437	1575	1424	1624	1444	1739	1470	1782	1529	1332	1086	1116	1129	1493	1135
Muzzle Energy — Total, in foot-tons	36040	31272	24868	16320	9942	8865	7834	..	..	12540	10880	8191	6680	5794	4591	3465	2477	2183	..	..	3887	2739	1459	—	—
Muzzle Energy — Per in. circ., ft. tons	694	684	592	388	293	261	331	..	..	317	275	241	197	195	155	144	103	107	..	..	115	92	61	—	—
Perforation at Muzzle, ins.	27·3	27·4	25·51	20·3	17·8	16·7	15·6	..	..	18·3	16·9	16·0	14·3	14·4	12·7	12·5	10·4	10·8	..	..	10·5	9·5	7·7	—	—

* Details of other guns of the pattern 1881, have been communicated confidentially to the British Government, viz. 27-cm., 24-cm., 16-cm., 10-cm., 9-cm., and 6·5-cm. There are a 16-cm. and 14-cm. coast artillery pattern, 1864–1866, not known here.

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GERMAN NAVAL ORDNANCE.

	Krupp Steel Breech-loading Guns, designated by calibre.																							Bronze L. L.
Designation in centimètres . .	30·5 jack'd.	26 long.	26 jack'd.	26 short.	24 long.	24 short.	21 long.	21 long.	21 short.	17 long.	17 short.	15 long.	15 short jack'd.	15 short.	15 short.	15 short jack'd.	15 short jack'd.	12·5 hoop'd.	12 hoop'd.	10·5 long.	8·7	8	8	8
Calibre, in inches . .	12·01	10·33	10·33	10·33	9·45	9·37	8·24	8·24	8·24	6·80	6·80	5·87	5·87	5·87	5·87	5·87	5·87	4·92	4·74	3·96	3·43	3·09	3·09	3·19
Length — Total, in feet . .	21·98	18·77	18·77	17·06	23·63	15·45	20·61	15·45	12·88	13·94	11·32	14·67	10·73	10·73	10·73	10·68	10·68	9·60	9·6	12·08	6·89	6·89	6·89	5·15
Length — Rifled portion, in ins.	181·9	149·8	150·0	129·3	201·6	116·2	176·5	124·6	114·9	117·1	102·2	128·5	93·3	87·1	86·7	87·1	86·7	85·7	85·3	113·6	62·7	57·6	57·6	45·9
Length — Powder Chamber „	45·3	44·7	44·4	44·7	53·5	40·9	46·7	37·1	34·0	31·5	16·7	31·1	19·0	25·1	25·5	25·1	25·5	16·7	16·7	19·5	10·7	10·5	10·5	9·73
Length — Bore, in calibres .	18·9	18·8	18·8	16·8	26·1	16·8	27·1	19·6	18·1	21·9	17·5	27·2	19·1	19·1	19·1	19·1	19·1	20·8	21·6	33·6	21·4	22·0	22·0	17·4
Number of Grooves . . .	72	36	48	36	56	48	48	30	30	30	30	36	36	36	24	36	24	32	18	32	24	12	12	12
Depth of Grooves, in inches .	0·079	0·077	0·079	0·077	0·059	0·061	0·059	0·102	0·102	0·063	0·063	0·059	0·061	0·061	0·061	0·061	0·061	0·059	0·051	0·049	0·049	0·049	0·049	0·051
Twist, in calibres . . .	45	50	50	50	25	45	25	68	59	45	45	25	45	45	68	50	65	40	60	25	40	46	46	46
Weight — Gun, including Breech Gear, tons	35·4	21·7	18·7	17·7	18·7	14·6	12·3	9·84	8·86	5·51	3·40	4·04	3·44	3·44	3·44	3·15	3·15	1·38	1·35	1·15	0·44	0·32	0·29	0·23
Weight — Breech Block, in lbs.	2954	2050	1973	1973	..	1378	908·3	831·1	831·1	496·0	414·5	390·2	324·1	324·1	324·1	324·1	381·4	163·1	163·1	149·9	86·0	63·9	63·9	55·1
Weight — Armour-piercing projectile, in lbs.	725·3	412·3	412·3	412·3	474·0	306·4	308·6	217·2	217·2	117·9	117·9	112·4	76·1	76·1	76·1	76·1	78·3	—	—	—	—	—	—	—
Weight — Common Shells, in lbs.	725·3	357·1	357·1	357·1	474·0	261·5	308·6	174·2	174·2	112·9	112·9	112·4	65·0	65·0	65·0	65·0	61·1	40·1	33·1	39·7	14·9	9·4	9·4	8·3
Weight of Bursting Charge — Armour-piercing Shells, in lbs.	6·6	5·3	5·3	5·3	7·1	3·2	4·6	2·8	2·8	1·3	1·3	..	0·8	0·8	0·8	0·8	—	—	—	—	—	—	—	—
Weight of Bursting Charge — Common Shells, in lbs.	22·0	17·3	17·3	17·3	19·0	15·4	12·3	10·5	10·5	6·0	6·0	..	4·2	4·2	4·2	4·2	..	2·4	2·5	—	0·4	0·6	0·6	0·6
Weight of Firing Charge — Armour-piercing Shells, in lbs.	202·8	105·8	105·8	125·7	149·9	67·2	99·2	41·9	35·3	30·9	16·5	33·1	14·3	17·1	13·2	17·1	13·2	—	—	—	—	—	—	—
Weight of Firing Charge — Common Shells, in lbs.	202·8	105·8	105·8	125·7	149·9	50·7	99·2	30·9	26·5	30·9	16·5	33·1	14·3	17·1	12·1	17·1	12·1	8·8	4·6	8·8	3·3	1·1	1·1	0·9
Initial Velocity — Armour-piercing projectile, feet-seconds.	1718	1588	1588	1578	1657	1493	1657	1463	1316	1608	1326	1624	1463	1463	1358	1463	1358	—	—	—	—	—	—	—
Initial Velocity — Common shell, ft.-sec.	1713	1641	1641	1654	1657	1391	1657	1394	1276	1654	1342	1624	1555	1555	1447	1555	1447	1545	1280	1526	1545	1148	1119	1053
Muzzle Energy — Total, foot-tons . .	14,740	7211	7211	7119	9024	4736	5876	3255	2606	2112	1436	2055	1131	1131	974	1131	1002	—	—	—	—	—	—	—
Muzzle Energy — Per inch circ., foot-tons	391	223	223	220	304	161	227	126	101	98·9	67·3	111·5	61·3	61·3	52·8	61·3	54·3	—	—	—	—	—	—	—
Perforation at Muzzle, in inches .	20·5	15·4	15·4	15·3	18·1	13·0	15·6	11·5	10·1	10·3	8·3	11·0	8·0	8·0	7·4	8·0	7·5	—	—	—	—	—	—	—

NOTE.—See two 40-cm. Krupp guns, given on Col. Maitland's Table, p. 357, viz. 71 tons and 119 tons weight.

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ITALIAN NAVAL ORDNANCE.

	Armstrong Breech Loading.				B.L.	Armstrong Muzzle Loading.							Muzzle Loading. Old Pattern.		Breech Loading.	
Designation by Calibre, in centimètres	43 New Pattern.	43* Early Pattern. 1882.	15	12	12	45	28 New Pattern.	25 No. 1 Long.	25 No. 2 Short.	25 No. 2.	22	20	16	16	7·5 No. 1.	7·5 No. 2.
Calibre, in inches	17	17	6	4·7	4·7	17·7	11	10	10	10	9	8	7	7	3	3
Length — Total, in feet	..	39	..	8·5	9·25	32·7	14·4	14·4	14	13·8	13·8	10·8	11·8	10·6	5·8	3·3
Length — Rifled Bore, in inches	..	336	..	76	88	305	121	120	114	112	106	89	96	87	52	27
Length — Powder Chamber, in inches	..	102·1	..	19·0	22	56·5	24·5	26·0	26·0	14·0	19·5	15·7	21·3	21·3	10·2	7·9
Length — Bore, in Calibres	28	25·6	..	20·2	23·5	20·5	13·2	14·6	14·0	12·6	13·9	13·1	16·8	15·5	20·7	11·7
No. of Grooves	..	84	..	37	36	28	9	7	7	8	6	6	6	6	12	12
Twist of Rifling, in Calibres.	..	..	..	40	42	50	35	40	40	55	45	45	42·5	27·3	48	48
Total Weight, in Tons.	104·3	101·5	..	1·20	1·38	99·9	25·0	18·0	18·0	12·1	12·6	7·02	5·12	3·54	0·29	0·095
Firing Charge — Armour-piercing projectile, in lbs.	899·5	661·4	33·1	..	..	507·1	94·8	77·2		63·9	59·5	37·5	19·8	—	—	—
Firing Charge — Common shell „	..	..	26·5	5·5	9·3	440·9	66·1	52·9		41·9	37·5	26·5	7·1	7·1	1·9	0·7
Weight. — Armour-piercing projectile, in lbs.	1799	2001·8	81·6	..	..	2001·8	560·0	451·9		331·8	316·4	192·9	101·4	—	—	—
Weight. — Common Shell, in lbs.	..	..	..	31·7	36·4	..	533·5	399·0		284·4	249·1	149·9	66·1		91·7	93·0
Weight. — Shrapnel, in lbs.	..	..	81·6	31·7	37·37	2177·7	533·5	399·0		284·4	249·1	149·9	66·1		91·7	93·0
Weight. — Case Shot „	..	..	36·4	23·5	35·9	..	200·1	188·1		135·6	99·6	79·4	33·1		64·6	64·6
Bursting Charge — Armour-piercing projectile, in lbs.	..	37·5	..	..	..	..	15·0	11·1		8·4	6·3	3·6	—		—	—
Bursting Charge — Common Shell, in lbs.	..	..	..	3·1	..	..	26·0	23·8		18·2	18·8	9·7	2·8		0·3	0·4
Bursting Charge — Shrapnel „	..	..	..	0·28	..	39·0	2·2	1·85		1·96	1·48	0·71	0·50		0·02	0·02
Muzzle Velocity, in feet	2018	1686	..	1394	1591	1614	1329	1388		1373	1388	1474	1303	1024	1335	—
Muzzle Energy — Total, foot-tons	†50,810	†39,488	..	..	..	36,178	6859	6035		4369	4224	2916	1195	—	—	—
Muzzle Energy — Per inch circumference, foot-tons	951·5	739·1	..	..	..	650·7	198·6	192·2		139·1	149·4	116·1	54·4	—	—	—
Perforation at Muzzle, inches	32·3	28·2	..	..	..	26·3	14·2	14·1		12·0	12·5	11·0	7·5	—	—	—

* At Spezia Grüson shield trial (see p. 321) the projectile weighed 2204·6 lbs. (100 kg.). The charge was 826·7 lbs. Cologne prismatic powder. The muzzle velocity was about 1775 feet, and muzzle energy 48,184.

† This energy has been greatly exceeded. Capt. Noble gives 51,900 for the 1882 pattern (p. 357).

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RUSSIAN NAVAL ORDNANCE.

	Obuchoff Steel Breech Loading Hooped Guns.											Steel B.L. Guns.		
Designation by Calibre, in inches	12 Long.	12	11	11 Pattern 77.	9	9	8	6 Long.	6·03	6	Long 9-pdr. Field.	9-pdr. Field.	Long 4-pdr. Field.	4-pdr. Field.
	12	12	11	11	9	9	8	6	6·03	6	4·2	4·2	3·43	3·43
Total Length, in feet	30	20	18·3	20·0	15·0	13	14·6	14	12·2	11·7	6·9	7·0	6·9	5·8
Length of Rifled Portion of Bore, in inches	..	165·0	152·0	158·0	124·0	..	128·0	118·7	106·0	98·0	61·5	65·0	62·6	53·0
Length of Powder Chamber „	..	38·5	35·0	50·4	28·5	..	23·0	30·5	22·4	22·2	10·5	8·0	10·7	—
Length of Bore in calibres, including Powder Chamber, in ins.	..	17	17	18·9	16·9	..	18·9	24·9	21·3	20	17·1	17·4	21·4	—
Number of Grooves, in inches	..	36	36	64	32	32	30	..	24	24	24	16	24	12
Depth of Grooves „	0·070	0·135	0·135	0·135	0·110	0·110	0·090	0·060	0·085	0·070	0·055	0·055	0·050	0·050
Twist of Rifling in calibres	..	73·5	70	..	60	60	70	*24	60	68	*40	50	40	41
Total Weight, in tons	42·7	39·9	28·2	28·2	15·0	12·5	9·67	4·07	4·35	4·03	0·60	0·87	0·45	0·35
Weight of Steel Shell, in lbs.	..	665·8	515·9	..	249·1	275·6	172·0	..	97·6	86·0	—	—	—	—
Weight of Chilled Shell, „	758·4	665·8	515·9	562·2	275·6	264·7	169·8	119·0	86·0	86·0	—	—	—	—
Weight of Common Shell, „	..	639·3	496·0	520·3	266·8	266·8	172·0	..	81·6	81·6	27·6	24·2	15·2	12·6
Weight of Case Shot, „	..	293·2	216·1	..	176·4	176·4	134·5	..	57·3	57·3	27·6	22·3	15·2	11·0
Weight of Firing Charge. Steel Shell, „	..	144·4	115·3	..	64·2	47·0	31·5	..	14·3	18·1	—	—	—	—
Weight of Firing Charge. Chilled Shell, „	282·2	144·6	90·6	132·2	47·0	47·0	29·3	37·5	14·3	18·1	—	—	—	—
Weight of Firing Charge. Common Shell, „	..	117·3	81·6	132·2	42·1	42·1	28·4	..	10·8	14·3	4·5	2·6	3·1	1·3
Muzzle Velocity, in feet	1959	1470	1486	1516	1463	1260	1352	..	1206	1463	—	—	—	—
Muzzle Energy Total, foot-tons	20180	9965	7905	8999	3701	3035	2180	..	982	1276	—	—	—	—
Muzzle Energy Per Inch Circumference, foot-tons	535·1	264·5	229·4	260·4	030·9	107·4	86·7	..	51·8	67·74	—	—	—	—
Perforation † at Muzzle, in inches	24·2	16·7	15·5	16·6	11·7	10·5	9·5	..	7·2	8·4	—	—	—	—

* Maximum of increasing twist. † Through iron unbacked.

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SPANISH NAVAL ORDNANCE.

	Hontoria, New Pattern.							Honoria.			Armstrong.			Krupp.		
	Breech Loading.										Muzzle Loading.			Breech Loading.		
Designation by Calibre	20-cm.	18-cm.	16-cm. No. 1.	16-cm.	12-cm.	9-cm.	7-cm.	18-cm.	16-cm. No. 2.	16-cm. No. 3.	10-in.	9-in.	8-in.	6-in.	87-cm.	75-cm.
Calibre, in inches	7·87	7·09	6·30	6·34	4·72	3·54	2·76	7·09	6·30	6·34	10·00	9·00	8·00	6·00	3·43	2·95
Length — Total length, in feet	17·3	15·6	13·8	18·8	10·4	7·8	3·7	10·5	9·5	9·6	14·1	13·0	11·3	14·5	6·9	6·3
Length — Rifled Portion, in inches	156·9	141·2	125·6	223·7	94·3	70·9	35·2	89·8	82·5	89·8	102·9	101·5	99·5	126·9	..	57·6
Length — Powder Chamber, in inches	40·0	35·9	31·9		23·8	17·7	6·1	26·5	22·8	17·3	..	..	..	29·7	—	—
Length — Bore, in calibres	25	25	25	35	25	25	15	16·4	16·7	16·9	..	..	..	26·1	—	—
No. of Grooves	46	42	38	..	30	22	18	42	38	38	7	6	4	28	24	—
Depth of Grooves, in inches	0·69	0·59	0·49	..	0·49	0·49	0·59	0·59	0·59	0·59	..	1·84	..	..	0·49	0·48
Twist of Rifling, in calibres	Increasing from 100 to 40							55	56·7	56·5	..	..	..	45	48	..
Total Weight, in tons	10·8	7·9	5·6	6·1	1·4	0·59	0·10	6·05	3·82	2·71	18·0	12·7	9·1	4·0	0·49	0·30
Weight — Armour-piercing projectile, in lbs.	183·0	135·6	93·7	132·3	..	..	..	135·6	93·7	..	299·8	249·1	180·0	80·0	—	—
Weight — Common Shell, in lbs.	163·1	120·4	83·8	..	36·2	15·4	7·28	120·4	83·8	63·9	..	..	..	80·0	—	—
Weight — Ring Segment, in lbs.	..	..	83·8	..	36·2	17·0	7·9	..	83·8	63·9	..	..	..	..	15·0	9·48
Firing Charge — Armour-piercing projectile, in lbs.	61·7	45·0	26·5	71·7	..	..	..	32·0	22·0	..	45·0	42·8	30·0	38·8	—	—
Firing Charge — Other projectiles „	..	..	24·3	..	13·2	5·7	1·1	..	..	15·4	..	..	..	24·9	10·3	10·4
Muzzle Velocity, in feet	..	..	1631	2051	..	..	..	..	..	..	..	..	..	2100	1526	1552
Muzzle Energy — Total, in foot-tons	..	..	1729	3860	..	..	..	..	..	..	..	..	..	2446	—	—
Muzzle Energy — Per inch circumference, foot-tons	..	..	87·4	193·8	..	..	..	..	..	..	..	..	..	129·8	—	—
Perforation at Muzzle, in inches	..	..	9·6	14·6	..	..	..	..	..	..	..	..	..	11·9	—	—

18 and 16-cm. Palliser guns and 16 and 13-cm. Parrot guns also exist.

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NAVAL ORDNANCE OF SWEDEN AND NORWAY.

	Sweden.				Norway.								
	Breech Loaders.			M.L.	Krupp, Hooped B.L.		Armstrong, M.L.				Palliser, M.L.		Cast-iron, M.L.
Designation by Calibre	27-cm.	24-cm.	17-cm.	12-cm.	26-cm.	15-cm.	8½-in.	8½-in.	8½-in.	6½-in.	5½-in.	5-in.	5-in.
Calibre, inches	10·80	9·45	6·58	4·80	10·24	5·91	10·51	10·51	10·51	7·88	6·58	6·11	6·11
Total Length, feet	17·46	14·96	11·27	8·87	18·77	12·63	16·87	14·66	13·49	10·82	11·58	10·30	11·21
Length — Rifled Portion of Bore in inches.	161·8	138·0	108·6	83·3	160·4	112·4	137·3	121·0	110·6	85·7	92·4	91·7	101·6
Length — Chamber, „	30·0	26·7	16·8	13·6	34·1	22·6	38·2	24·0	20·5	18·5	19·3	10·8	14·5
Length — Bore in calibres, „	17·8	17·4	19·1	20·2	19·0	22·8	16·7	13·8	12·5	13·2	17·0	16·8	19·0
Number of Grooves	5	5	5	8	60	36	8	8	8	6	3	3	3
Twist of Rifling	..	30	..	40	45	45	55	55	55	50	34	34	34
Total Weight, tons	23·9	14·4	5·2	1·9	21·7	3·9	21·4	19·5	18·1	7·5	4·8	3·4	2·9
Weight of — Chilled Shell, lbs.	476·2	317·5	108·0	..	463·0	86·0	447·5	385·8	385·8	153·2	110·2	—	—
Weight of — Common Shell, „	396·8	224·9	76·3	34·6	381·4	69·4	308·6	308·6	308·6	148·8	82·7	59·1	59·1
Weight of Firing Charge — Chilled Shell, lbs.	98·1	59·5	23·4	..	99·2	18·7	121·3	71·7	66·1	29·7	22·0	—	—
Weight of Firing Charge — Common Shell, „	66·1	37·5	17·6	6·6	81·6	18·7	77·2	38·6	38·6	19·8	11·0	7·17	7·17
Muzzle Velocity, feet	1365	1322	1378	..	1575	1575	1555	1378	1296	1296	1329	—	—
Total foot-tons	6152	3848	1422	..	7966	1479	7502	5082	4495	1785	1350	—	—
Muzzle Energy — Per inch Circumference	179·6	129·6	68·8	..	247·7	79·7	227·3	153·9	136·1	72·1	65·3	—	—
Muzzle Energy — Perforation through Iron	13·65	11·5	8·4	..	16·2	9·2	15·6	12·6	11·8	8·6	8·2	—	—

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UNITED STATES—NAVAL ORDNANCE.

Chiefly under construction or projected.

NAME OF GUN.		Length of Gun.				Twist Weight.		Weight of Projectiles.		Charge.				
	Calibre.	Total Length.	Length of Bore.		Rifled Portion.	Powder Chamber.	Twist of Rifling.	Total Weight.	Armour Piercing.	Common.	Firing.	Bursting.	Initial Velocity.	Muzzle Energy.	Perforation of Wrought Iron at Muzzle.
	inch.	inch.	inch.	Cal.	inch.	inch.		tons.	lbs.	lbs.	lbs.	lbs. or oz.	ft. per sec.	ft.-tons.	inch.
FINISHED.															
5-in. B.L.R.	5	162·0	152	30·6	120·75	29·2		2·77	60	60	30	3	1950	1,582	10·5
UNDER CONSTRUCTION.															
6-in. B.L.R.	6	196·0	185·75	31·00	144·26	39·5	1 turn in 30 cals.	4·58	100	100	50	6	2000	2,773	12·7
8-in. B.L.R.	8	258·0	242·15	30·3	199·0	45·5		12·28	250	250	125	13	2150	8,011	18·7
10-in. B.L.R.	10	329·0	310·0	31·0	246½	61·0		26·0	500	500	250	22	2100	15,285	23·1
10½-in. B.L.R.	10½	368·6	350·0	33·3	281·8	69·0		29·0	550	550	275	24	2100	16,813	23·7
DESIGNED.															
12-in. B.L.R.	12	421·8	400·0	33·33	319·3	79·3		47·0	850	850	415	38	2100	25,984	27·6
16-in. B.L.R.	16	511·5	481·0	30·0	385·0	95·0		110·0	2000	2000	1000	90	2100	61,140	36·6

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TABLE RELATING TO CONVERSION OF MEASURES.

Length.

METRIC TO ENGLISH. ENGLISH TO METRIC.

Mètres.	Yards.	Feet.	Inches.	Yards.	Mètres.	Feet.	Mètres.	Inches.	Centimètres.
1	1·0936	3·2809	39·37	1	0·91438	1	0·30479	1	2·5400
2	2·1873	6·5618	78·74	2	1·82877	2	0·60959	2	5·0799
3	3·2809	9·8427	118·11	3	2·74315	3	0·91438	3	7·6199
4	4·3745	13·1236	157·48	4	3·65753	4	1·21918	4	10·1598
5	5·4682	16·4045	196·85	5	4·57192	5	1·52397	5	12·6998
6	6·5618	19·6854	236·22	6	5·48630	6	1·82877	6	15·2397
7	7·6554	22·9663	275·60	7	6·40068	7	2·13356	7	17·7797
8	8·7491	26·2472	314·97	8	7·31507	8	2·43836	8	20·3196
9	9·8427	29·5281	354·34	9	8·22945	9	2·74315	9	22·8596

EXPLANATION.—To convert any number from one measure to the other, take the values of the different multiples of 10 by shifting the position of the decimal point, and add together. Thus, find the number

of yards in 2354 mètres (see cols. 1 and 2).	of feet in 12·4 mètres (see cols. 1 and 3).	of inches in 30·5 centimètres (see cols. 1 and 4). Note, 1 m.=100 cm.	of mètres in 1026 yards (see cols. 5 and 6).	of mètres in 1742 feet (see cols. 7 and 8).	of centimètres in 17·72 ins.
mètres. yards.	mètres. feet.	cms. inches.	yards. mètres.	feet. mètres.	inches. cms.
2000=2187·3	10 =32·809	30·0=11·811	1000=914·38	1000=304·79	10·0 =25·400
300= 328·09	2 = 6·562	·5= ·197	20= 18·29	700=213·36	7·0 =17·780
50= 54·68	0·4= 1·312		6= 5·49	40= 12·19	0·7 = 1·778
4= 4·37				2= ·61	·02= ·051
∴ 2354=2574·44	∴ 12·4=40·683	∴ 30·5=12·008	∴ 1026=938·16	∴ 1742=530·95	∴ 17·72=45·009

Weight.

METRIC TO ENGLISH. ENGLISH TO METRIC.

Kilogrammes.	Tons.	Pounds Avoirdupois.	Grains Troy.	Tons.	Milliers.	Pounds Avoirdupois.	Kilogrammes.	Grains. Troy.	Gramme.
1	·000984	2·2046	15432·3	1	1·016	1	0·4536	1	·0648
2	·001968	4·4092	30864·7	2	2·032	2	0·9072	2	·1296
3	·002953	6·6139	46297·0	3	3·048	3	1·3608	3	·1944
4	·003937	8·8185	61729·4	4	4·064	4	1·8144	4	·2592
5	·004921	11·0231	77161·7	5	5·080	5	2·2680	5	·3240
6	·005905	13·2277	92594·1	6	6·096	6	2·7216	6	·3888
7	·006889	15·4323	108026·4	7	7·112	7	3·1751	7	·4536
8	·007874	17·6370	123458·8	8	8·128	8	3·6287	8	·5184
9	·008858	19·8416	138891·1	9	9·144	9	4·0823	9	·5832

EXPLANATION.—To convert any number from one measure to the other, take the values of the different multiples of 10 by shifting the position of the decimal point and add together. Thus, find the number

of tons in 35 milliers (see cols. 1 and 2. Note, 1000 kg. =1 millier).	of pounds in 56·3 kilogrammes. (see cols. 1 and 3).	of grains in 120 grammes (see cols. 1 and 4. Note, 1000 grms. = 1 kg.)	of milliers in 38 tons (see cols. 5 and 6).	of kilogrammes in 68 pounds (see cols. 7 and 8).	of grammes in 85 grains (see cols. 9 and 10).
milliers. tons.	kgrms. lbs.	grammes. grains.	tons. milliers.	lbs. kgs.	grains. grammes.
30 = 29·53	50 =110·231	100=1543·23	30 = 30·48	60 = 27·216	80 = 5·184
5 = 4·92	6 = 13·228	20= 308·65	8 = 8·13	8 = 3·629	5 = ·324
	0·3= .661				
∴ 35 = 34·45	∴ 56·3=124·120	∴ 120=1851·88	∴ 38 = 38·61	∴ 68 = 30·845	∴ 85 = 5·508

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PRESSURE.

Metric to English.			English to Metric.				Atmospheric to English.		English to Atmospheric.	
Kilogrammes per square centimètre.	Pounds per square inch.	Tons per square inch.	Pounds per square inch.	Kilogrammes per square centimètre.	Tons per square inch.	Kilogrammes per square centimètre.	Atmospheres.	Tons per square inch.	Tons per square inch.	Atmospheres.
1	14·223	·00635	1	·07031	1	157·49	1	·00656	1	152·38
2	28·446	·01270	2	·14062	2	314·99	2	·01313	2	304·76
3	42·668	·01905	3	·21093	3	472·48	3	·01969	3	457·14
4	56·891	·02540	4	·28124	4	629·97	4	·02625	4	609·52
5	71·114	·03175	5	·35155	5	787·47	5	·03281	5	761·91
6	85·337	·03810	6	·42186	6	944·96	6	·03938	6	914·29
7	99·560	·04445	7	·49217	7	1102·45	7	·04594	7	1066·67
8	113·783	·05080	8	·56248	8	1259·95	8	·05250	8	1219·05
9	128·005	·05715	9	·63279	9	1417·44	9	·05906	9	1371·43

NOTE.—One atmosphere is taken to be 14·7 lbs. per square inch.

EXPLANATION.—To convert any number from one measure to the other, take the values of the different multiples of 10 by shifting the position of the decimal point, and add together. Thus, find the number

of pounds per square inch in 32·1 kilogrammes per square centimètre (see cols. 1 and 2).		of tons per square inch in 3210 kilogrammes per square centimètre (see cols. 1 and 3).		of kilogrammes per square centimètre in 15 lbs. per square inch (see cols. 4 and 5).		of kilogrammes per square centimètre in 18·3 tons per square inch (see cols. 1 and 2).		of tons per square inch in 3254 atmospheres. (see cols. 8 and 9).		of atmospheres in 14·6 tons per square inch (see cols. 10 and 11).	
kgs. per sq. cm.	lbs. per sq. in.	kgs. per sq. cm.	tons per sq. in.	lbs. per sq. in.	kgs. per sq. cm.	tons per sq. in.	kgs. per sq. cm.	atmospheres.	tons per sq. inch.	tons per sq. in.	atmospheres.
30	= 426·68	3000	= 19·05	10	= ·7031	10	= 1574·9	3000	= 19·69	10	= 1523·8
2	= 28·45	200	= 1·27	5	= ·3516	8	= 1259·95	200	= 1·31	4	= 609·5
0·1	= 1·42	10	= ·06			0·3	= 47·25	50	= ·33	·6	= 91·4
∴ 32·1	= 456·55	∴ 3210	= 20·38	∴ 15	= 1·0547	∴ 18·3	= 2882·1	∴ 3254	= 21·36	∴ 14·6	= 2224·7

ENERGY.

Metric to English.		English to Metric.	
Mètre-tons.	Foot-tons.	Foot-tons.	Mètre-tons.
1	3·2291	1	0·3097
2	6·4581	2	0·6194
3	9·6872	3	0·9291
4	12·9162	4	1·2388
5	16·1453	5	1·5484
6	19·3743	6	1·8581
7	22·6034	7	2·1678
8	25·8324	8	2·4775
9	29·0615	9	2·7872

1000 mètre-tons is termed a "dinamode" in Italy.

EXPLANATION.—To convert any number from one measure to the other, take the values of the different multiples of 10 by shifting the position of the decimal point, and add together. Thus find the number

of foot-tons in 4367 mètre-tons (see cols. 1 and 2).		of mètre-tons in 3592 foot-tons (see cols. 3 and 4).	
mètre-tons.	foot-tons.	foot-tons.	mètre-tons.
4000	= 12916·2	3000	= 929·1
300	= 968·72	500	= 154·84
60	= 193·74	90	= 27·87
7	= 22·60	2	= ·62
∴ 4367	= 14101·26	∴ 3592	= 1112·43

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APPENDIX.[1]

BRITISH AND FOREIGN NAVY ESTIMATES,

1886–87.

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COMMISSIONERS FOR EXECUTING THE OFFICE OF LORD HIGH ADMIRAL OF THE UNITED KINGDOM OF GREAT BRITAIN AND IRELAND, &c.

THE RIGHT HONOURABLE LORD GEORGE F. HAMILTON.
ADMIRAL SIR ARTHUR W. A. HOOD, K.C.B.
VICE-ADMIRAL SIR ANTHONY H. HOSKINS, K.C.B.
VICE-ADMIRAL W. GRAHAM, C.B.
CAPTAIN LORD CHARLES W. D. BERESFORD, C.B., M.P.
E. ASHMEAD-BARTLETT, Esq., M.P.

Parliamentary and Financial Secretary:
ARTHUR B. FORWOOD, Esq., M.P.

Permanent Secretary:
EVAN MACGREGOR, Esq., C.B.

FLAG-OFFICERS IN COMMISSION, OFFICERS COMMANDING SQUADRONS, &c., FLAG-LIEUTENANTS, AND SECRETARIES.

Stations.	Flagships.	Flag Officers.	(1) Appointed. (2) Assumed Command.	Flag-Lieutenants.	Secretaries.
Nore . .	Duncan .	Vice-Admiral H.S.H. the Prince of Leiningen, G.C.B.	(1) 1 July 85 (2) 1 July 85	Charles E. F. C. Graham.	William Risk.
Portsmouth .	Duke of Wellington.	Admiral Sir George O. Willes, K.C.B.	(1) 28 Nov 85 (2) 28 Nov 85	Henry R. P. Floyd.	Charles E. Gifford.
Devonport .	Royal Adelaide.	Admiral Augustus Phillimore.	(1) 1 Dec 84 (2) 1 Dec 84	Godfrey H. B. Mundy.	James Cox.
Queenstown. Ireland .	Revenge .	Rear-Admiral Henry D. Hickley.	(1) 28 Mar 85 (2) 28 Mar 85	Reginald F. Yonge.	Robert J. M.Macleod.
Channel Squadron.	Minotaur	Vice-Admiral Sir William N. W. Hewett, K.C.B., K.C.S.I.	(1) 18 Mar 86 (2) 18 Mar 86	George V. Hegan.	Henry C. W. Gibson.
	Agincourt	Rear-Admiral Algernon C. F. Heneage. (Second in command.)	(1) 3 July 85 (2) 5 July 85	Thomas U. Thynne.	Richard B. White.
Mediterranean	Alexandra	Vice-Admiral H.R.H. the Duke of Edinburgh, K.G., K.T., K.P., G.C.S.I., G.C.M.G., K.C.B., AdC. (with local rank of Admiral).	(1) 5 Feb 86 (2) 5 Mar 86	Charles T. Gimlette.	Henry H. Rickard.

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FLAG-OFFICERS IN COMMISSION, OFFICERS COMMANDING SQUADRONS, &c., FLAG-LIEUTENANTS, AND SECRETARIES—*continued.*

Stations.	Flagships.	Flag Officers.	(1) Appointed. (2) Assumed Command.	Flag-Lieutenants.	Secretaries.
North America and West Indies.	Belle-rophon.	Vice-Admiral the Rt. Hon. The Earl of Clanwilliam, C.B., K.C.M.G.	(1) 25 Aug 85 (2) 1 Oct 85	Reginald A. Cave-Browne-Cave.	George Love.
	Urgent .	Commodore Francis M. Prattent. (Commodore in charge at Jamaica.)	(1) 24 July 83 (2) 3 Sept 83	None allowed	Joseph Green.
Pacific . .	Triumph	Rear-Admiral Sir Michael Culme-Seymour, Bart.	(1) 4 July 85 (2) 16 Aug 85	Frank A. Garforth.	Edward Robinson.
China .	Audacious	Vice-Admiral Richard V. Hamilton, C.B.	(1) 1 Sept 85 (2) 12 Nov 85	Augustus L. K. Knapton.	Francis E. G. Dent
	Victor Emanuel.	Commodore George D. Morant. (Commodore in charge at Hong Kong.)	(1) 12 Feb 84 (2) 26 Apr 84	None allowed	Edward W. Keey.
East Indies .	Bacchante	Rear-Admiral Sir Frederick W. Richards, K.C.B.	(1) 18 May 85 (2) 4 June 85	Robert B. S. Wrey.	John Carlisle.
Australia .	Nelson .	Rear-Admiral George Tyron, C.B.	(1) 12 Nov 84 (2) 23 Jan 85	William C. Pakenham.	Charles J. Pawsey.
Cape of Good Hope and West Coast of Africa .	Raleigh .	Rear-Admiral Sir Walter J. Hunt-Grubbe, K.C.B.	(1) 6 Mar 85 (2) 15 May 85	Charles M'Crea	Henry W. Paul.
S. E. Coast of America.	Ruby .	Captain William R. Kennedy. (Senior Officer.)	(1) 14 Dec 85 (2) 2 Feb 86	None allowed	
Training Squadron.	Active .	Commodore Robert O'B. Fitz Roy, C.B.	(1) 30 Sept 85 (2) 12 Oct 85	None allowed	Harry Robinson.
Admiral Superintendent at Portsmouth.	Asia .	Rear-Admiral Frederick A. Herbert.	(1) 6 Apr 83 (2) 6 Apr 83	None allowed	H. C. L. Connolly (civilian)
Admiral Superintendent at Devonport.	Indus .	Rear-Admiral Henry D. Grant, C.B.	(1) 10 July 85 (2) 16 July 85	None allowed	W. T. Archer (civilian)
Admiral Superintendent at Chatham.	Pembroke	Rear-Admiral William Codrington, C.B.	(1) 1 May 86 (2) 1 May 86	None allowed	George H. Salmon (civilian)
Admiral Superintendent at Malta.	Hibernia	Rear-Admiral Hon. William J. Ward.	(1) 25 Mar 85 (2) 26 Apr 85	Edward J. Bain.	William T. Fencock.
Admiral Superintendent of Naval Reserve.	Hercules	Vice-Admiral John K. E. Baird.	(1) 6 Sept 85 (2) 6 Sept 85	None allowed	William W. Perry.

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ENGLISH NAVY

Votes.		Estimates, 1886–87. Gross Estimate.	Appropriations in Aid.	Net Estimate.
	I. Numbers.			Total Numbers.
A.	Total Number of Officers, Seamen, Boys, Coastguard, and Royal Marines	... ..	... ..	61,400
	II.—Effective Services.	£	£	£
1	Wages, &c., of Seamen and Marines .	3,021,635	118,735	2,902,900
2	Victuals and Clothing for Seamen and Marines	1,233,300	268,900	964,400
3	Admiralty Office	207,920	4,520	203,400
4	Coastguard Service and Royal Naval Reserves, &c.	207,667	67	207,600
5	Scientific Branch	134,638	21,438	113,200
6	Dockyards and Naval Yards at Home and Abroad	1,730,317	817	1,729,500
7	Victualling Yards at Home and Abroad	70,760	60	70,700
8	Medical Establishments at Home and Abroad	67,060	60	67,000
9	Marine Divisions	21,734	34	21,700
10	Naval Stores for Building and Repairing the Fleet, &c., Machinery and Ships Built by Contract:			
..	Section I.—Naval Stores . .	1,356,000	150,000	1,206,000
..	Section II.—Machinery and Ships Built by Contract, &c. . . .	2,371,300	... ..	2,371,300
11	New Works, Buildings, Yard Machinery, and Repairs . . .	630,653	6,953	623,700
12	Medicines and Medical Stores, &c. .	81,560	18,960	62,600
13	Martial Law, &c.	9,400	... ..	9,400
14	Miscellaneous Services	140,760	5,060	135,700
	£	11,284,704	595,604	10,689,100
	III.—Non-Effective Services.			
15	Half-pay, Reserved Half-pay, and Retired Pay to Officers of the Navy and Marines	812,950	50	812,900
16	Military and Civil Pensions and Allowances:			
..	Section I.—Military Pensions and Allowances	905,871	71	905,800
..	Section II.—Civil Pensions and Allowances	333,801	501	333,300
	£	2,052,622	622	2,052,000
	Total for the Naval Service . £	13,337,326	596,226	12,741,100
	IV.—Extra Estimate for Services not Naval.			
17	Freight, &c., for the Army (Conveyance of Troops)	313,300	61,300	252,000
	Balances written off as Irrecoverable in 1884–5	... ..	... ..	... ..
	Grand Total . . £	13,650,626	657,526	12,993,100

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ESTIMATES.

Estimates, 1885–86, Including Supplementary Estimate.			Difference on Net Estimates.		Actual Expenditure, 1884–85, including Supplementary Estimates.	Votes.
Gross Estimate.	Appropriations in Aid.	Net Estimate.	Increase.	Decrease.		
		Total Numbers.	Numbers.	Numbers.		
.. ..	.. ..	61,500	.. ..	100	.. ..	A.
£	£	£	£	£	£	
2,894,805	120,705	2,774,100	128,800	.. ..	2,725,573	1
1,221,361	276,261	945,100	19,300	.. ..	897,295	2
202,820	4,520	198,300	5,100	.. ..	187,788	3
205,300	.. ..	205,300	2,300	.. ..	191,658	4
132,465	19,865	112,600	600	.. ..	105,969	5
1,672,270	770	1,671,500	58,000	.. ..	1,616,653	6
71,400	100	71,300	.. ..	600	70,318	7
67,650	50	67,600	.. ..	600	68,603	8
21,740	40	21,700	.. ..	.. ..	19,932	9
						10
1,544,500	196,500	1,348,000	.. ..	142,000	1,243,072	Sec. I.
2,126,000	.. ..	2,126,000	245,300	.. ..	1,001,609	Sec. II.
668,500	7,900	660,600	.. ..	36,900	468,316	11
80,810	19,010	61,800	800	.. ..	67,390	12
10,000	.. ..	10,000	.. ..	600	8,047	13
149,311	5,211	144,100	.. ..	8,400	161,127	14
11,068,932	650,932	10,418,000	460,200	189,100	8,833,350	
830,451	51	830,400	.. ..	17,500	845,117	15
905,250	50	905,200	600	.. ..	887,377	Sec. I.
330,795	495	330,300	3,000	.. ..	328,884	Sec. II.
2,066,496	596	2,065,900	3,600	17,500	2,061,378	
13,135,428	651,528	12,483,900	463,800	206,600	10,894,728	
319,900	108,900	211,000	41,000	.. ..	729,679	17
.. ..	.. ..	.. ..	.. ..	.. ..	1,402	
13,455,328	760,428	12,694,900	504,800	206,600	11,625,809	
			Net Increase, £298,200			

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NUMBER OF OFFICERS, SEAMEN, BOYS, COASTGUARD, AND ROYAL MARINES, FOR WHOM PROVISION IS MADE IN THE NAVY ESTIMATES, 1886–87.

Sixty-one Thousand Four Hundred.

	Flag Officers.	Commissioned Officers.	Subordinate Officers.	Warrant Officers.	Chief Officers.	Petty Officers, Seamen, &c.	Boys.	Numbers, all Ranks. 1886–87.		Numbers, all Ranks. 1885–1886.	
FLEET—SERVICE AFLOAT. (Including Indian Troop Ships).											
Officers and Seamen	13	2,185	344	638	..	25,314	..	28,494		*27,757	
Reserves and under Training	..	501	151	244	..	7,411	..	8,307		7,289	
Pensioners	..	..	..	..	..	650	..	650		640	
Estimate, 1886–87	13	2,686	495	882	..	33,375	..	..	37,451		
Estimate, 1885–86	13	2,628	488	829	..	31,728	..	..	..	..	*35,686
BOYS.											
For service in the Fleet	..	..	..	..	..	..	3,874	3,874		3,078	
Under instruction in Training Ships	..	..	..	..	..	..	2,600	2,600		2,800	
									6,474		5,878
COASTGUARD. Officers and Men:											
Estimate, 1886–7	..	96	..	1	224	3,679	..	4,000			
									4,000		
Estimate, 1885–1886	..	97	..	1	221	3,681	..	..	..	4,000	
											4,000

	Commissioned Officers.	Warrant Officers.	Staff Serjeants and Serjeants.	Buglers and Musicians.	Rank and File.				
ROYAL MARINES.							47,925		45,564
Head Quarters Staff	5	2	4	..	..	11		11	
Service Afloat	86	..	231	114	6,003	6,434		†6,600	
Service on Shore	249	36	581	249	5,147	6,262		6,159	
Estimate, 1886–87	340	38	816	363	11,150	..	12,707		
Estimate, 1885–86	341	36	798	356	11,239	..	..	..	†12,770
Numbers provided for in Vote 1	..	..	..	..	..	..	60,632	..	58,334

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In Naval Establishments on Shore.	Flag Officers.	Commissioned Officers.	Warrant Officers.	Petty Officers, Seamen, &c.	Boys.				
Officers and Seamen borne on Ships' Books:									
Officers Superintending Her Majesty's Dockyards, &c., and their Retinues	4	6	..	20	..	30		30	
Officers and Seamen	1	103	22	393	26	545		506	
Estimate, 1886–87	5	109	22	413	26	..	575		
Estimate, 1885–86	5	104	18	383	26	..	..	...	536

Royal Marines borne on Ships' Books, or at Divisional Head Quarters:	Commissioned Officers.	Serjeants.	Bugler.	Rank and File.				
Estimate, 1886–87	27	17	1	148	193			
Estimate, 1885–86	29	13	..	88	..	193 ..	130	130
Numbers provided for in other Votes	..	..	..	..		768	..	666
								59,000
Supplementary Estimate (18th February, 1886) Number of Men of all Ranks required for Navy Service in addition to the Number already Voted					..	..	..	2,500
Total Numbers					..	61,400	..	61,500
Net Decrease								100

* Including 500 Officers and Seamen, voted additional for service in Egypt.
† Including 500 Marines, voted additional for service in Egypt.

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NUMBERS OF OFFICERS AND MEN OF THE NAVY, ROYAL MARINES, ROYAL NAVAL RESERVE, SEAMEN AND MARINE PENSIONERS RESERVE, AND ROYAL NAVAL ARTILLERY VOLUNTEERS.

		Numbers by latest Returns.
FLEET SERVICE:		
Officers and Seamen		37,149
Boys		6,741
COASTGUARD		3,896
ROYAL MARINES		12,844
NAVAL ESTABLISHMENTS ON SHORE:		
Officers, Seamen, &c.		575
Royal Marines		193
ROYAL NAVAL RESERVE:		
Officers	325	
Men	17,890	
		18,215
SEAMEN AND MARINE PENSIONERS RESERVE		*2,072
ROYAL NAVAL ARTILLERY VOLUNTEERS:		
Officers	70	
Men	1,357	
		1,427
Total		83,112

* *Note.*—In addition to this number all Pensioners whose age shall not exceed 55 years, are liable to be called up for active service in case of war or any emergency. The number may be taken as about 10,000.

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NUMBER OF ENGLISH SHIPS AND VESSELS IN COMMISSION ON THE 1ST NOVEMBER, 1885, COMPARED WITH THE NUMBER IN COMMISSION ON THE 1ST NOVEMBER, 1884.

CLASS OF SHIPS.	IN COMMISSION.		NUMBER. More or Less on 1st November, 1885.	
	On 1st November, 1885.	On 1st November, 1884.	More.	Less.
STEAM SHIPS.				
Armour-plated Ships	30	30	..	..
Frigates	1	..	1	..
Corvettes	26	22	4	..
Torpedo Ram	1	1	..	..
Sloops	16	14	2	..
Gun Vessels	22	22	..	..
Gunboats	48	45	3	..
Miscellaneous Vessels	25	26	..	1
Despatch Vessels	2	2	..	..
Troop Ships and Troop Store Ships	7	7	..	..
Indian Troop Ships	4	4	..	..
Royal Yachts	4	4	..	..
Surveying Vessels	5	4	1	..
	191	181	11	1
SAILING VESSELS.				
Sloop	1	1	..	..
Schooners	4	4	..	..
Training Brigs	6	6	..	..
Miscellaneous Vessels	..	..	..	..
Coastguard Tenders (late Revenue Cruisers)	19	23	..	4
	30	34	..	4
STATIONARY SHIPS.				
Flag, Receiving, Steam Reserve, and Store Ships	15	15	..	..
Training and Drill Ships	22	21	1	..
	37	36	1	..
	258	251	12	5
MORE ON NOVEMBER 1ST, 1885			7.	

In addition to the Ships and Vessels in Commission above specified, there will be a larger number of Torpedo Boats in the Navy in 1886-87 than in 1885-86.

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LIST of NEW SHIPS and VESSELS Estimated to be passed into the FIRST RESERVE during the Years 1886–87 and 1885–86.

1886–87.				1885–86.			
NAME OF SHIP.	Load Displacement in Tons.	Indicated Horse Power.	Number of Guns.	NAME OF SHIP.	Load Displacement in Tons.	Indicated Horse Power.	Number of Guns.
ARMOURED SHIPS:				**ARMOURED SHIPS:**			
Edinburgh . . . . Armour-plated Turret Ship.	9,150	7,520	9	Conqueror . . . . Armour-plated Turret Ship.	6,200	6,000	6
Rodney . . . . . Armour-plated Barbette Ship.	9,700	11,160	10	Impérieuse . . . . Armour-plated Barbette Cruiser.	7,390	10,180	10
Warspite . . . . . Armour-plated Barbette Cruiser.	7,390	8,000	10	Collingwood . . . . Armour-plated Barbette Ship.	9,150	9,570	10
PROTECTED SHIP:				Colossus . . . . . Armour-plated Turret Ship.	9,150	7,490	9
Mersey . . . . . 2nd Class Steam Cruiser.	3,550	6,000	12				
				PARTIALLY PROTECTED SHIPS:			
UNPROTECTED SHIPS:				Amphion . . . . 2nd Class Steam Cruiser.	3,750	5,000	10
Alacrity . . . . . Steel Despatch Vessel.	1,400	3,180	6	Arethusa . . . . 2nd Class Steam Cruiser.	3,750	5,000	10
Surprise . . . . . Steel Despatch Vessel.	1,400	3,180	6	Phaeton . . . . . 2nd Class Steam Cruiser.	3,750	5,000	10
Archer . . . . . Steel Torpedo Cruiser.	1,630	3,500	6	Leander . . . . . 2nd Class Steam Cruiser.	3,750	5,000	10
Mohawk . . . . . Steel Torpedo Cruiser.	1,630	3,500	6	Calliope . . . . Steel and Iron Corvette (Wood Sheathed).	2,770	3,000	16
Fearless . . . . . Steel Torpedo Cruiser.	1,430	3,200	4	Calypso . . . . . Steel and Iron Corvette (Wood Sheathed).	2,770	3,000	16
Scout . . . . . Steel Torpedo Cruiser.	1,430	3,200	4	Pylades . . . . . Composite Sloop.	1,420	1,640	14
Swallow . . . . . Composite Gun Vessel.	1,070	1,500	8				
Landrail . . . . . Gun and Torpedo Vessel.	785	1,200	4	**UNPROTECTED SHIPS:**			
Bramble . . . . . Composite Gunboat.	670	1,000	6	Acorn . . . . . Composite Gun Vessel.	970	1,200	8
Lizard . . . . . Composite Gunboat.	670	1,000	6	Icarus . . . . . Composite Gun Vessel.	970	1,200	8
Rattler . . . . . Composite Gunboat.	670	1,200	6	Mariner . . . . . Composite Gun Vessel.	970	970	8
Wasp . . . . . Composite Gunboat.	670	1,000	6	Racer . . . . . Composite Gun Vessel.	970	920	8
Rattlesnake . . . . Torpedo Gunboat.	450	2,700	1	Curlew . . . . . Gun and Torpedo Vessel.	785	1,200	4

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Ships Building or Completing in Her Majesty's Dockyards, 1886–87.

Name of Ship.	Description.	Displacement Tonnage.	Speed. Knots.	Number of Guns.	Where Building.
ARMOURED SHIPS:					
Camperdown . .	Armour-plated Barbette Ship.	10,000	17	10	Portsmouth.
Howe . . .	„ „	9,700	17	10	„
Trafalgar . .	Armour-plated Turret Ship.	11,940	16·5	12	„
Edinburgh . .	„ „	9,150	15·4	9	„
Rodney . . .	Armour-plated Barbette Ship.	9,700	17	10	„
Hero . . .	Armour-plated Turret Ship.	6,200	15·50	6	Chatham.
Warspite . .	Armour-plated Barbette Cruiser.	7,390	17	10	„
Immortalité . .	Armour-plated Cruiser .	5,000	18	12	„
Anson . . .	Armour-plated Barbette Ship.	10,000	17	10	Pembroke.
Nile . . .	Armour-plated Turret Ship	11,940	16·5	12	„
Aurora . . . 11	Armour-belted Cruiser .	5,000	18	12	„
PROTECTED SHIPS:					
Mersey . . .	2nd Class Steel Cruiser	3,550	18	12	Chatham.
Severn . . .	„ „	3,550	18	12	„
Thames . . .	Steel 2nd Class Steel Cruiser.	3,550	18	12	Devonport.
Forth . . . 4	2nd Class Steel Cruiser	3,550	18	12	Pembroke.
UNPROTECTED SHIPS:					
Scout . . .	Steel Torpedo Cruiser .	1,430	16 to 17	4	Portsmouth.
Surprise . . .	„ „	1,400	17	6	„
Landrail . . .	Gun and Torpedo Vessel	785	14	4	Devonport.
Racoon . . .	Steel Torpedo Cruiser .	1,630	16 to 17	6	„
Serpent . . .	„ „	1,630	16 to 17	6	„
Sandfly . . .	Steel Torpedo Gunboat .	450	19	1	„
Spider . . .	„ „	450	19	1	„
Grasshopper . .	„ „	450	19	1	Sheerness.
Buzzard . . .	Composite Gun Vessel .	1,080	15	8	„
Swallow . . .	„ „	1,070	13·5	8	„
Melita . . . 11	Composite Sloop . .	.	12·5	..	Malta.
Total . 26					

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SHIPS BUILDING BY CONTRACT, 1886–87.

Name of Ship.		Description.	Displacement Tonnage.	Speed. Knots.	Number of Guns.	By whom Building.
ARMOURED VESSELS:						
Benbow		Armour-plated Barbette Ship.	10,000	17	12	Thames Ironworks.
Sans Pareil		Armour-plated Turret Ship.	10,470	16·75	15	„
Renown		„ „	10,470	16·75	15	Armstrong, Mitchell & Co.
Australia		Steel - Armoured Cruiser.	5,000	18	12	R. Napier & Sons.
Galatea		„ „	5,000	18	12	„
Orlando		„ „	5,000	18	12	Palmer's Co.
Undaunted		„ „	5,000	18	12	„
Narcissus		„ „	5,000	18	12	Earl's Co.
	8					
UNPROTECTED SHIPS:						
Archer		Steel Torpedo Cruiser	1,630	16 to 17	6	J. & J. Thompson.
Brisk		„ „	1,630	16 „ 17	6	„
Cossack		„ „	1,630	16 „ 17	6	„
Mohawk		„ „	1,630	16 „ 17	6	„
Porpoise		„ „	1,630	16 „ 17	6	„
Tartar		„ „	1,630	16 „ 17	6	„
Fearless		„ „	1,430	16 „ 17	4	Barrow Shipbuilding Co.
Rattler		Composite Gunboat	670	13·7	6	Armstrong, Mitchell & Co.
Wasp		„ „	670	13	6	„
Lizard		„ „	670	13	6	Harland & Wolff.
Bramble		„ „	670	13	6	„
Rattlesnake		Steel Torpedo Gunboat.	450	19	1	Laird Bros.
Bann		Tank Vessel	250	..	..	Passage Docks Co. Cork.
	13					
Total	21					

Torpedo Boats	2	113 ft. in length.
„ „	53	125 „ „
„ „	1	135 „ „
„ „	1	150 „ „
Total Torpedo Boats	57	

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Abstract of Ships building in 1886–87.

	Dockyards.	Contract.	Total.
Armoured Ships . . .	11	8	19
Protected Ships . . .	4	..	4
Unprotected Ships . . .	11	13	24
Torpedo Boats . . .	..	57	57
	26	78	104

Appropriation of Labour in H.M.'s Dockyards at Home and at Malta.

	1886–7. Number of Men to be employed.	1885–6. Number of Men to be employed.
New Construction of Armoured Ship . .	6,345	5,012
„ „ Protected Ship . .	1,574	1,562
„ „ Unprotected Ships .	2,339	1,830
Repairs of Ships	6,067	5,990
Yard Manufactures	1,765	1,666
Yard and Harbour Services	2,940	2,935
	21,030	18,995*

* Exclusive of men employed out of amount allowed under Vote of Credit.

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A List of the Armoured and Unarmoured Fighting Ships of England laid down to Build since April, 1880.

Rate.	Name.	When Laid Down.
1880.		
Armour-plated Steel Barbette Ship	Collingwood.	12 July
Steam Cruiser .	Leander *pp.* .	14 June
„ „	Phaeton *pp.*	14 June
„ „	Arethusa *pp.*	14 June
Composite Sloop .	Satellite * *pp.*	4 Oct.
„ „	Heroine * *pp.*	30 Aug.
„ „	Hyacinth * *pp.*	30 Aug.
Composite Gunboat	Starling .	19 Aug.
„ „	Stork . .	19 Aug.
„ „	Raven . .	19 Aug.
1881.		
Armour-plated Steel Barbette Ship	Impérieuse .	10 Aug.
Armour-plated Steel Barbette Ship .	Warspite .	25 Oct.
Steam Cruiser .	Amphion *pp.*	25 April
Corvette (Steel and Iron) . . .	Calliope *pp.* .	1 Oct.
Corvette (Steel and Iron) . . .	Calypso *pp.* .	1 Sept.
Composite Sloop .	Rapid * *pp.* .	21 April
„ „	Royalist * *pp.*	27 April
„ „	Caroline * *pp.*	24 Oct.
Composite Gunboat	Albacore .	2 Sept.
„ „	Mistletoe .	2 Sept.
„ „	Watchful .	2 Sept.
Composite Gun Vessel . .	Dolphin † .	10 Oct.
Composite Gun Vessel . .	Wanderer † .	10 Oct.
Composite Steam Vessel . .	Alecto . .	16 Jan.
Composite Steam Vessel . .	Sphinx .	26 Aug.
1882.		
Armour-plated Steel Barbette Ship .	Camperdown	18 Dec.
Armour-plated Steel Barbette Ship .	Benbow .	1 Nov.
Armour-plated Steel Barbette Ship .	Howe . .	7 June
Armour-plated Steel Barbette Ship .	Rodney .	6 Feb.
Composite Gun Vessel . .	Acorn . .	16 Oct.
1883.		
Armour-plated Steel Barbette Ship .	Anson . .	24 April
Steam Cruiser (Steel)	Mersey P. .	9 July
Composite Sloop .	Pylades * *pp.*	1 Jan.
Composite Gun Vessel . .	Mariner .	8 Jan.
Composite Gun Vessel . .	Reindeer .	15 Jan.
Composite Gun Vessel . .	Racer . .	9 April
Composite Gun Vessel . .	Melita . .	18 July
1884.		
Armour-plated Steel Turret Ship and Ram . . .	Hero . .	21 April
Steam Cruiser (Steel)	Severn P. .	1 Jan.
„ „	Thames P. .	14 April
„ „	Forth P. .	1 Dec.
1885 (to 1 Feb.)		
Torpedo Cruiser (Steel) . .	Scout . .	8 Jan.
Armed Despatch Vessel . .	Alacrity ‡ .	14 Feb.
Armed Despatch Vessel . .	Surprise ‡ .	14 Feb.

* Re-classified as a Corvette by A. O., 28 July, 1883.
† Re-classified as a Sloop by A. O., 27 May, 1884.
‡ Alacrity and Surprise were not intended to be fighting ships when first laid down, but armaments were ordered for them in January, 1886.

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A List of the Armoured and Unarmoured Fighting Ships of England laid down to Build since April, 1880—*continued.*

Rate.	Name.	When Laid Down.	Rate.	Name.	When Laid Down.
1885—*continued.*			**1885.—*continued.***		
Armed Despatch Vessel	Fearless	22 Sept.	Armour - Belted Cruiser	Narcissus	27 April
Composite Gun Vessel	Icarus	18 Aug.	Armour - Belted Cruiser	Orlando	23 April
Composite Gun Vessel	Swallow	1 Jan.	Armour - Belted Cruiser	Undaunted	23 April
Gun and Torpedo Vessel (Steel)	Curlew	5 Jan.	Composite Gunboat	Bramble	25 Aug.
			„ „	Lizard	25 Aug.
Gun and Torpedo Vessel (Steel)	Landrail	5 Jan.	„ „	Rattler	17 Aug.
			„ „	Wasp	17 Aug.
Armoured Turret Ship	Renown	23 April	Torpedo Gunboat	Rattlesnake	— Nov.
Armoured Turret Ship	Sans Pareil	21 April	**1886.**		
Torpedo Cruiser	Archer	2 March	Torpedo Cruiser	Racoon	1 Feb.
„ „	Brisk	2 March	Armoured Belted Cruiser	Immortalité	18 Jan.
„ „	Cossack	2 March			
„ „	Mohawk	2 March	Armoured Belted Cruiser	Aurora	1 Feb.
„ „	Porpoise	2 March	Ironclad Turret	Trafalgar	18 Jan.
„ „	Serpent	9 Nov.	„ „	Nile	8 April
„ „	Tartar	2 March	Torpedo Gunboat	Sandfly	19 April
Armour - Belted Cruiser	Australia	21 April	„ „	Grasshopper	27 April
			„ „	Spider	7 June
Armour - Belted Cruiser	Galatea	21 April	Composite Sloop	Buzzard	1 May

(For corresponding Table of Fighting Ships of France, laid down since 1880, see page 463.)

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Estimated Expenditure for Armoured, Protected, and

Numbers. 1885-86.	Numbers. 1886-87.	Class of Ships and Vessels Building and Completing.	Ships Building in H.M.'s Dockyards. Cost of Building and Completing.	Estimated Expenditure. To 31 March, 1886.	Estimated Expenditure. In 1886-87.	Liabilities for future Years.	Ships Building by Contract. Contract Price.	Estimated Expenditure. To 31 March, 1886.	Estimated Expenditure. In 1886-87.	Cost of Completing in H.M.'s Dockyards.	Liabilities for future Years.
			£	£	£	£	£	£	£	£	£
19	19	ARMOURED . .	4,977,838	2,584,413	999,661	1,393,764	2,333,253	926,480	767,320	..	639,45
								3,729	*30,000*	*255,000*	(a) *221,27*
5	4	PROTECTED . .	561,700	343,134	152,728	65,838	..	..	..	..	..
4	..	PARTIALLY PROTECTED (b)	..	..	..	..	..	..	..	..	..
35	26	UNPROTECTED	325,440	99,572	125,340	100,528	340,690	209,400	231,292	..	..
								16,364	*101,240*	*160,634*	(c) *43,030*
10	57	TORPEDO BOATS . . .	..	..	..	..	175,240	94,150	81,090	..	..
									48,458	*65,048*	(c) *16,590*
..	..	SUNDRY SERVICES . .	..	..	..	..	10,000	..	10,000	..	..
73	106	TOTAL . .	5,864,978	3,027,119	1,277,729	1,560,130	2,859,183	1,230,030	989,700	..	639,453
							..	*20,093*	*179,698*	*480,682*	(c) *280,891*
		Add, for Vessels which are not included in the above figures, because they have been completed as regards Contract Work, and are now completing in H.M.'s Dockyards.					183,959	183,959	..	..	..
							£ 3,043,142	1,434,082	..	..	..

Abate, for Gun Mountings, &c., not for vessels *building*, but for vessels being *repaired* or *re-armed*, and for

TOTAL Estimated Expenditure to be borne by

(a) The figures in *Italics* are the amounts to be spent at the Dockyards for completing Vessels built or building by contract.

Abstract of Estimated Expenditure for Labour, Materials, and Gun

Numbers. 1885-86.	Numbers. 1886-87.	Class of Ships.	Ordinary 1886-87.
			£
19	19	ARMOURED	1,420,157
5	4	PROTECTED	194,576
4	..	PARTIALLY PROTECTED	4,052
35	26	UNPROTECTED	433,701
10	57	TORPEDO BOATS	282,047
..	..	SUNDRY SERVICES	263,933
73	106	TOTAL of Expenditure during 1886-87 on all Ships Building and Completing for Sea . . . £	2,597,566

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Unprotected Ships, Torpedo Boats, and Sundry Services.

Propelling Machinery.				Gun Mountings, Torpedo Carriages, and Gear.				Total.		Guns. — Expenditure to be borne by the War Department.
Contract Price.	Estimated Expenditure. To 31 March, 1886.	Estimated Expenditure. In 1886–87.	Liabilities for future Years.	Contract or Estimated Price.	Estimated Expenditure. To 31 March, 1886.	Estimated Expenditure. In 1886–87.	Liabilities for future Years.	Estimated Expenditure to 31 March, 1887.	Liabilities for future Years.	
£	£	£	£	£	£	£	£	£	£	£
1,220,396	474,662	370,638	375,096	927,270	195,715	227,216	504,339	6,546,105 *33,729*	2,912,652 *221,271*	814,795
156,000	120,253	29,277	6,470	31,383	18,785	12,571	27	676,748	72,335	76,096
..	..	..	..	16,585	2,629	4,052	9,904	6,681	9,904	..
436,722	182,967	206,755	47,000	113,086	32,029	55,813	25,244	1,043,166 *117,604*	172,772 *43,030*	190,729
165,800	87,970	77,830	..	137,815	..	134,090	3,725	475,130 *48,458*	3,725 *16,590*	56,600
46,000	..	46,000	..	70,222	2,149	52,658	15,415	110,807	15,415	..
2,024,918	865,852	730,500	428,566	1,296,361	251,307	486,400	558,654	8,858,637 *199,791*	3,186,803 *280,891*	1,138,220
587,153	587,153	..	..	..	..	..	..	771,112	..	..
2,612,071	1,453,005	..	..	..	..	..	..	9,829,540	..	..
sundry other services				141,620	..	141,620	..	141,620	..	..
			£	1,154,741	..	344,780	..	9,687,920	..	..
Naval Votes for Vessels Building and Completing . . . . . £								**13,155,614**		

(*b*) The amounts shown under this head are for Gun Mountings and Torpedo Gear for Ships completed in previous years.

Mountings for Vessels Building in H.M.'s Dockyards and by Contract.

Expenditure.	Additional Expenditure.	Total.		
1885–86.	**1886–87.**	**1885–86.**	**1886–87.**	**1885–86.**
£	£	£	£	£
1,238,098	974,678	627,225	2,394,835	1,865,323
307,420	....	....	194,576	307,420
100,759	....	....	4,052	100,759
380,804	186,737	292,186	620,438	672,990
330,572	59,421	126,500	341,468	457,072
567,995	10,325	....	273,358	582,755
2,925,648*	**1,231,161**	**1,060,671***	**3,828,727**	**3,986,319***

* Including Supplementary Estimate, dated 18th February, 1886; also the Expenditure out of the Vote of Credit.

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RETURN of the GUNS which are being Manufactured for the ARMAMENT of HER MAJESTY'S SHIPS now under CONSTRUCTION, 1886–87.

Description of Guns.	Number being Prepared.				Where Guns are being Constructed.
	For Armoured Ships.	For Protected Ships.	For Unprotected Ships.	Total.	
16·25 inch 110 tons .	5	..	...	5	Sir W. Armstrong & Co.
13·5 „ 66 „ . .	*18	..	..	18	Royal Gun Factory, Sir W. Armstrong & Co., and Messrs. Whitworth & Co.
12 „ 43 „ . .	6	..	..	6	Royal Gun Factory.
10 „ 29 „ . .	1	..	..	1	Sir W. Armstrong & Co.
9·2 „ 22 „ . .	*15	..	..	15	Royal Gun Factory, or Sir W. Armstrong & Co.
8 „ 14 „ . .	..	13	..	13	Royal Gun Factory, and Sir W. Armstrong & Co.
6 „ 5 „ . .	*93	40	49	182	Royal Gun Factory, Sir W. Armstrong & Co., and Messrs. Whitworth & Co.
5 „ 40 cwt.. .	..	..	*43	43	Royal Gun Factory, and Sir W. Armstrong & Co.
4 „ 25 „ .. .	..	..	28	28	Royal Gun Factory.
6-pounder Quick Firing	157	12	8	177	Mr. Nordenfelt, and Messrs. Hotchkiss & Co.
3 „ „ „	80	..	184	264	Messrs. Hotchkiss & Co.
9-pounder 8 cwt. . .	15	4	..	19	Royal Gun Factory.
9 „ 6 „ . .	1	4	..	5	Royal Gun Factory.
7 „ 200 lbs. .	16	4	11	31	Royal Gun Factory.
1-inch 4-bar Nordenfelt.	73	24	..	97	Mr. Nordenfelt.
1 „ 2 „ „ .	11	..	140	151	Mr. Nordenfelt.
0·45-inch 5-bar Nordenfelt	38	..	24	62	Mr. Nordenfelt.
0·45 „ 5 „ Gardner's	28	8	14	50	Royal Small Arms Factory, Enfield.
0·45 „ 2 „ „	..	..	6	6	Royal Small Arms Factory, Enfield.

* Including those not yet in hand, for which money is taken in Army Estimates, 1886–87.

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STATEMENT of the ACTUAL EXPENDITURE for NAVAL SERVICE (excluding the Conveyance of Troops), for each Year from 1860–61 to 1886–87, inclusive, showing respectively the Effective and Non-Effective Expenditure.

(Estimated Expenditure for the Years 1885–86 and 1886–87 has been inserted.)

Year.	Effective.	Non-Effective.	Total.	Year.
	£	£	£	
1860–61 . . .	10,735,607	1,293,277	12,028,884	1860–61
1861–62 . . .	10,769,206	1,324,904	12,094,110	1861–62
1862–63 . . .	9,729,698	1,345,456	11,075,154	1862–63
1863–64 . . .	8,893,160	1,351,912	10,245,072	1863–64
1864–65 . . .	8,903,219	1,350,226	10,253,445	1864–65
1865–66 . . .	8,517,119	1,387,623	9,904,742	1865–66
1866–67 . . .	8,527,797	1,416,427	9,944,224	1866–67
1867–68 . . .	9,464,500	1,432,371	10,896,871	1867–68
1868–69 . . .	9,302,017	1,443,161	10,745,178	1868–69
1869–70 . . .	7,976,286	1,533,369	9,509,655	1869–70
1870–71 . . .	7,957,205	1,713,133	9,670,338	1870–71
1871–72 . . .	7,894,854	1,724,570	9,619,424	1871–72
1872–73 . . .	7,602,925	1,771,403	9,374,328	1872–73
1873–74 . . .	8,376,223	1,802,819	10,179,042	1873–74
1874–75 . . .	8,660,016	1,846,504	10,506,520	1874–75
1875–76 . . .	8,853,173	1,869,451	10,722,624	1875–76
1876–77 . . .	9,152,357	1,887,571	11,039,928	1876–77
1877–78 . . .	10,435,442	1,910,906	12,346,348	1877–78
1878–79 . . .	9,001,199	1,941,448	10,942,647	1878–79
1879–80 . . .	8,196,075	2,005,498	10,201,573	1879–80
1880–81 . . .	8,055,875	2,059,300	10,115,175	1880–81
1881–82 . . .	8,363,392	2,079,026	10,442,418	1881–82
1882–83* . . .	8,594,373	2,067,811	10,662,184	1882–83
1883–84 . . .	8,436,845	2,077,204	10,514,049	1883–84
1884–85 . . .	8,834,752	2,061,378	10,896,130	1884–85
1885–86 . . .	12,125,610	2,054,900	14,180,510†	1885–86
1886–87 . . .	10,689,100	2,052,000	12,741,100	1886–87

*† From this date extra receipts were taken in aid of the votes.
† Including Vote of Credit.

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ABSTRACT OF THE ENGLISH NAVY ESTIMATES,

	Vote.	1866–67.	1867–68.	1868–69.	1869–70.	1870–71.	1871–72.
	—	Numbers, 67,238.	Numbers, 67,300.	Numbers, 67,120.	Numbers, 63,300.	Numbers. 61,000.	Numbers, 61,000.
		£	£	£	£	£	£
Wages to Seamen and Marines	1	2,866,559	2,950,952	3,036,634	2,762,353	2,692,731	2,723,336
Victuals and Clothing for Seamen and Marines.	2	1,235,188	1,241,614	1,335,842	1,172,268	968,857	1,038,202
Admiralty Office . .	3	173,655	176,018	182,364	168,704	159,368	163,499
Coast Guard Service, Royal Naval Reserves, &c.	4	274,119	267,067	243,926	224,073	196,955	187,830
Scientific Branch . .	5	63,958	65,106	63,565	62,820	68,794	67,103
Dockyards, &c., at Home and Abroad.	6	1,376,971	1,375,368	1,223,562	1,086,004	878,352	967,418
Victualling Yards, at Home and Abroad.	7	85,624	86,395	87,179	80,671	69,267	68,334
Medical Establishments, at Home and Abroad.	8	59,289	62,686	64,824	54,757	57,730	57,906
Marine Divisions . .	9	15,550	17,448	20,709	16,566	18,122	18,021
Naval Stores	10 I	1,003,501	855,511	892,908	801,572	779,090	837,965
Machinery and Ships built by Contract.	10 II	338,000	860,559	1,092,500	767,070	466,173	751,716
New Works, Buildings, &c.	11	892,865	888,588	814,237	749,816	744,232	850,994
Medicines and Medical Stores	12	75,664	80,664	78,164	79,300	73,150	67,600
Martial Law, &c. . .	13	20,605	21,332	20,365	18,144	16,678	16,005
Miscellaneous Services .	14	105,950	168,450	175,800	120,650	118,791	127,617
Half-Pay, &c.	15	701,708	704,937	700,166	723,231	902,100	829,238
Military Pensions and Allowances.	16 I	528,904	528,667	550,447	569,728	635,666	633,785
Civil Pensions and Allowances	16 II	213,837	218,915	223,498	222,566	287,134	312,237
		10,031,947	10,570,277	10,806,690	9,680,293	9,133,190	9,718,806
Army Department (Conveyance of Troops).	17	402,788	405,976	350,600	316,348	237,340	173,150
		10,434,735	10,976,253	11,157,290	9,966,641	9,370,530	8,891,956

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FROM 1872–73 TO 1886–87.

1872–73.	1873–74.	1874–75.	1875–76.	1876–77.	1877–78.	1878–79.	1879–80.	1880–81.
Numbers, 61,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 58,800.	Numbers. 58,800.
£	£	£	£	£	£	£	£	£
2,674,145	2,629,884	2,603,757	2,644,062	2,634,904	2,684,048	2,707,240	2,708,695	2,721,536
1,062,269	1,035,719	1,085,534	1,107,781	1,153,367	1,178,610	1,146,192	1,003,375	1,013,524
173,767	174,983	178,066	183,916	189,820	193,890	200,760	185,400	179,485
174,500	167,575	163,311	188,505	210,230	207,900	207,510	193,870	194,278
72,741	98,654	113,120	107,324	109,194	109,002	106,041	105,576	113,107
978,983	1,152,080	1,253,326	1,326,649	1,323,750	1,341,680	1,446,140	1,355,000	1,363,585
68,344	70,935	73,385	75,548	76,400	76,930	76,740	76,570	71,160
59,926	62,214	63,701	64,644	65,830	66,150	66,400	67,030	63,445
18,728	18,683	18,720	18,868	20,053	21,316	21,139	21,408	21,402
928,510	1,120,380	1,175,159	1,285,770	1,261,320	1,207,300	1,382,300	1,030,000	1,011,000
477,116	629,366	828,679	903,608	1,353,600	1,042,000	1,152,000	842,000	749,000
716,091	682,218	682,061	644,751	569,249	537,715	540,615	566,749	558,950
70,800	70,800	70,745	73,530	76,230	78,010	79,730	75,710	75,150
16,110	16,080	15,605	15,904	15,114	8,147	7,994	7,985	9,250
117,297	105,288	123,410	156,423	143,547	130,134	139,725	140,530	135,760
818,626	862,462	870,166	889,511	888,472	880,796	891,605	891,615	895,156
638,311	643,216	657,090	681,781	726,136	759,940	790,297	803,920	823,219
309,185	296,448	288,670	284,529	282,176	279,981	284,223	301,211	322,428
9,375,449	9,836,985	10,264,505	10,653,104	11,099,392	10,803,549	11,266,651	10,376,644	10,321,435
156,700	167,740	175,600	172,090	197,480	204,080	863,250	210,250	381,500
9,532,149	10,004,725	10,440,105	10,825,194	11,296,872	11,007,629	12,129,901	10,586,894	10,702,935

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ABSTRACT OF THE ENGLISH NAVY ESTIMATES FROM 1872–73 TO 1886–87—*continued.*

	VOTE.	1881–82.	1882–83.	1883–84.	1884–85.	1885–86.	1886–87.
	—	Numbers, 58,100.	Numbers, 57,500.	Numbers. 57,250.	Numbers, 56,950.	Numbers, 61,500.	Numbers, 61,400.
		£	£	£	£	£	£
Wages to Seamen and Marines	1	2,704,226	2,803,941	2,754,700	2,839,490	2,894,805	3,021,635
Victuals and Clothing for Seamen and Marines.	2	1,014,481	1,313,227	1,232,700	1,196,239	1,221,361	1,233,300
Admiralty Office . .	3	108,583	186,147	187,387	192,970	202,820	207,920
Coast Guard Service, Royal Naval Reserves, &c.	4	194,481	195,416	195,800	196,900	205,300	207,667
Scientific Branch . .	5	120,382	131,791	130,976	131,600	132,465	134,638
Dockyards, &c., at Home and Abroad.	6	1,446,346	1,447,736	1,561,858	1,586,170	1,672,270	1,730,317
Victualling Yards, at Home and Abroad.	7	71,917	71,950	72,007	71,230	71,400	70,760
Medical Establishments, at Home and Abroad.	8	65,969	64,515	64,950	69,450	67,650	67,060
Marine Divisions . .	9	22,138	22,066	22,350	21,740	21,740	21,734
Naval Stores . . .	10 I	1,172,700	1,320,000	1,347,000	1,429,300	1,544,500	1,356,000
Machinery and Ships built by Contract.	10 II	683,239	767,153	1,052,600	1,049,400	2,126,000	2,371,300
New Works, Buildings, &c.	11	550,141	561,853	471,250	491,065	668,500	630,653
Medicines and Medical Stores	12	70,460	85,825	75,825	80,520	80,810	81,560
Martial Law, &c. . .	13	10,069	9,973	10,400	10,400	10,000	9,400
Miscellaneous Services .	14	127,421	155,786	151,005	181,716	149,311	140,760
Half-Pay, &c. . . .	15	877,890	873,688	864,920	853,977	830,451	812,950
Military Pensions and Allowances.	16 I	847,035	869,177	876,950	889,641	905,250	905,871
Civil Pensions and Allowances	16 II	337,991	330,965	330,180	328,903	330,795	333,801
		10,497,469	11,211,209	11,402,858	11,620,711	13,135,428	13,337,326
Army Department (Conveyance of Troops).	17	448,450	402,700	331,100	687,800	319,900	313,300
		10,945,919	11,613,909	11,733,958	12,308,511	13,455,328	13,650,626

In 1882–83 and subsequent years the amounts are shown in gross, including appropriations in aid.

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COMPARATIVE TABLE, showing approximately PRINCIPAL VOTES in NAVY ESTIMATES for ENGLAND and FRANCE.

	1883–84. England.	1883. France.	1884–85. England.	1884. France.	1885–86. England.	1885. France.	1886–87. England.	1886. France.
	£	£	£	£	£	£	£	£
Wages to Seamen and Marines	2,921,900	2,398,800	3,048,130	2,426,700	3,121,813	2,404,208	3,251,032	2,380,456
Victuals—including Victualling Yards . . .	1,041,100	807,831	1,248,469	824,763	1,292,761	814,064	1,304,060	799,348
Admiralty Office. . .	182,300	58,900	192,970	50,400	202,820	54,192	207,920	54,140
Scientific Branch . .	119,800	30,000	131,600	30,400	132,465	29,892	134,638	29,892
Dock Yards . . .	1,562,000	1,258,969	1,578,170	1,212,937	1,672,270	1,140,812	1,730,317	1,141,668
Hospital Establishments and Medical Stores . .	130,500	124,400	145,970	120,400	148,460	112,532	148,620	121,232
Purchase of Stores. Machinery and Ships built by Contract	2,430,900	2,172,800	2,587,200	2,010,600	3,809,000	1,964,360	3,882,953	1,964,360
New Works and Buildings .	368,300	437,400	386,300	367,700	530,000	372,948	475,000	372,920
Martial Law . . .	10,400	9,000	10,400	9,000	10,000	9,000	9,400	12,940
Miscellaneous Services .	147,800	210,200	172,716	205,700	149,311	200,092	140,760	210,444
Total . .	8,915,000	7,508,300	9,501,925	7,258,600	11,068,900	7,102,100	11,284,700	7,087,400

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AMOUNTS provided in ENGLISH and FRENCH ESTIMATES for NAVAL ORDNANCE, 1878–79 to 1886–87.

Year.	ENGLAND. (Army and Navy Estimates.)	FRANCE. (Budgets Extraordinaires included.)
	£	£
1878–79 . . .	507,000	360,000
1879–80 . . .	397,000	542,000
1880–81 . . .	377,968	550,000
1881–82 . . .	458,686	573,420
1882–83 . . .	740,691	685,984
1883–84 . . .	792,023	681,083
1884–85 . . .	794,497	653,345
1885–86 . . .	1,399,232	773,276
1886–87 . . .	1,752,900	773,228
Total . .	7,219,997	5,592,336

The Ordnance provided for in the French Navy Estimates includes the armament of forts for coast defence.

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Stations of Her Majesty's Ships in Commission.

[With the Dates and Ports of Commission corrected up to July 3.]

ARMOURED SHIPS, CORVETTES, SLOOPS, AND GUN-VESSELS.

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned. When	Commissioned. Where.	Station.
Active	12	337	Corvette	Capt. R. O'B. FitzRoy, C.B.	Sept. 21, 1885	Portsmouth	Training Squadron.
Agamemnon	6	400	Armrd. turret ship	Capt. A. T. Dale	Sept. 16, 1884	Plymouth	Mediterranean.
Agincourt	17	710	Armrd. brdsd. ship	Capt. Lord C. T. Scott, C.B. (Rear-Admiral Heneage)	Re. Oct. 1, 1883	Devonport	Channel Squadron.
Ajax	6	400	Armrd. turret ship	Capt. Durrant, C.M.G.	Aug. 5, 1885	Devonport	Greenock (C. G.).
Alacrity	6	94	Steel despatch ves.	Com. R. B. Maconochie	June 22, 1886	Portsmouth	Fitting for China.
Albacore	4	30	Gunboat	Lt.-Com. L. E. Wintz	Feb. 14, 1884	Devonport	Mediterranean.
Albatross	4	125	Sloop	Com. Charles Hicks	Re. Feb. 24, 1883	Hong Kong	China.
Alecto	4	68	P. vessel	Lt.-Com. John D. Deane	Re. Sept. 27, 1885	Cape Coast C'stle	Cape & W.C. of Africa
Alexandra	12	674	Armrd. brdsd. ship	Capt. John Fellowes, C.B. (Admiral Duke of Edinburgh)	Re. Mar. 3, 1886	Malta	Mediterranean.
Audacious	10	490	Armrd. brdsd. ship	Capt. R. H. Harris (Vice-Ad. R. V. Hamilton, C.B.)	Re. Jan. 7, 1886	Hong Kong	China.
Bacchante	14	424	Corvette	Capt. A. W. Moore (R.-Ad. Sir F. Richards, K.C.B.)	April 14, 1885	Portsmouth	East Indies.
Banterer	4	59	Gunboat	Lt.-Com. E. Hodgkinson	October 1, 1882	Devonport	Particular service.
Belleisle	4	188	Armrd. brdsd. ship	Capt. Guy O. Twiss	July 2, 1878	Chatham	Kingstown (C. G.).
Bellerophon	14	331	Armrd. brdsd. ship	Capt. C. C. P. Fitzgerald (Admiral Earl of Clanwilliam)	Dec. 15, 1885	Devonport	N. America & W. I.
Britomart	2	27	Gunboat	Lt.-Com. F. V. Isaac	October 1, 1882	Portsmouth	Particular service.
Briton	14	221	Corvette	Capt. Rodney M. Lloyd	Re. May 1, 1884	Suakim	East Indies.
Bullfrog	4	60	Gunboat	Lt.-Com. J. Masterman	Re. April 21, 1885	Bermuda	N. America & W. I.
Calypso	16	291	Corvette	Capt. J. C. Burnell	Sept. 21, 1885	Chatham	Training Squadron.
Canada	10	266	Corvette	Capt. A. C. Curtis	May 1, 1883	Portsmouth	N. America & W. I.
Caroline	14	161	Corvette	Capt. Sir W. Wiseman, Bt.	January 27, 1886.	Sheerness	Pacific.
Carysfort	14	252	Steel corvette.	Capt. A. E. Dupuis	Re. April 15, 1884	Malta	Mediterranean.
Champion	14	265	Corvette	Capt. A. T. Powlett	Re. Dec. 16, 1883	Hong Kong	China.

Extract from *Army and Navy Gazette*, 3 July, 1886.

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Stations of Her Majesty's Ships in Commission—*continued.*

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned.		Station.
					When.	Where.	
Cleopatra	14	252	Corvette	Capt. L. C. Keppel	Re. Dec. 12, 1883	Hong Kong	China.
Cockatrice	2	58	P. vessel	Com. W. Wilson	Re. Dec. 12, 1885	Malta	Danube.
Cockchafer	4	60	Gunboat	Lt.-Com. H. H. Boteler	January 2, 1883	Devonport	China.
Colossus	9	325	Armrd. turret ship	Capt. C. A. G. Bridge	April 13, 1886	Portsmouth	Special service.
Comus	12	274	Corvette	Capt. T. S. Jackson	April 6, 1886	Sheerness	N. America & W. I.
Condor	3	83	Gun-vessel	Com. H. J. May	Re. Dec. 20, 1883	Malta	Mediterranean.
Conquest	14	285	Corvette	Capt. C. L. Oxley	April 18, 1885	Devonport	Pacific.
Constance	14	265	Corvette	Capt. S. H. P. Dacres	Re. Jan. 17, 1886	Hong Kong	China.
Coquette	4	60	Gunboat	Lieut.-Com. W. Farr	Re. Feb. 1, 1883	Malta	Mediterranean.
Cormorant	6	123	Sloop	Com. J. E. T. Nicholls	May 26, 1885	Portsmouth	Pacific.
Curlew	4	90	Gun & torp. vessel	Com. Anthony Kingscote	June 22, 1886	Devonport	Fitting for service.
Cygnet	4	60	Gunboat	Lt.-Com. A. H. Lindesay	Re. Feb. 1, 1883	Malta	Mediterranean.
Daring	4	123	Sloop	Com. E. H. M. Davis	Re. Dec. 12, 1883	Hong Kong	China.
Dee	3	27	Gunboat	Lt.-Com. Hon. A. Stanhope	January 27, 1886	Malta	Temporary service.
Devastation	4	356	Armrd. turret ship	Capt. P. Luxmore, C.B.	September 7, 1885	Portsmouth	Queensferry (C. G.).
Diamond	12	233	Corvette	Capt. F. S. Clayton	Re. Jan. 14, 1885	Sydney	Australia.
Dido	12	203	Corvette	Capt. F. S. Vander-Meulen	Re. March, 1883	Barbados	N. America & W. I.
Dolphin	4	100	Sloop	Com. Eardley Wilmot	May 1, 1884	Sheerness	Mediterranean.
Don	3	27	Gunboat	Lt.-Com. R. B. Abdy	January 27, 1886.	Malta	Temporary service.
Dragon	6	139	Sloop	Com. Charles V. Anson	Re. Nov. 1, 1882.	Malta	Ordered home.
Dreadnought	4	440	Armrd. turret ship	Capt. F. G. D. Bedford, C.B.	October 14, 1884.	Portsmouth	Mediterranean.
Emerald	12	222	Corvette	Capt. R. H. Hamond	March 2, 1886	Pacific	N. America & W. I.
Espoir	4	60	Gunboat	Lt.-Com. H. R. Adams	January 11, 1883	Devonport	China.
Express	4	28	Gunboat	Lt.-Com. H. L. Fleet	Feb. 14, 1884	Devonport	Cape & W.C. of Africa
Falcon	3	100	Gun-vessel	Com. J. G. Jones	Re. Feb. 10, 1885	Malta	Mediterranean.
Fantome	4	125	Sloop	Com. R. H. Archer	Re. April 25, 1883	Bermuda	N. America & W. I.
Firebrand	4	60	Gunboat	Lt.-Com. D. L. Dickson	May 6, 1884	Devonport	China.
Flirt	4	79	Gun-vessel	Com. Robert W. Craigie	Re. March 1, 1884	Devonport	Devonp't (paying off)
Forward	4	60	Gunboat	Lt.-Com. A. Furlonger	Nov. 20, 1883	Sheerness	N. America & W. I.
Frolic	4	79	Gun-vessel	Com. A. A. C. Parr	July 26, 1883	Sheerness	S. E. C. of America.
Gannet	7	140	Sloop	Com. B. R. Bradford	Sept. 3, 1885	Sheerness	Mediterranean.
Garnet	12	231	Corvette	Capt. Henry H. Boys	Sept. 7, 1882	Sheerness	Ordered home.
Goshawk	4	60	Gunboat	Lt.-Com. W. J. Moore	Nov. 22, 1883	Sheerness	N. America & W. I.
Grappler	4	60	Gunboat	Lt.-Com. C. H. Cochran	Re. Feb. 18, 1885	Gibraltar	Mediterranean.

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Hecla	6	245	Torp. depôt ship	Capt. E. Jeffreys	Re. Oct. 1, 1885	Devonport	Mediterranean.
Hercules	14	357	Armrd. brdsd. ship.	Capt. H. W. Brent (V.-Ad. J. K. E. Baird)	May 1, 1881	Portsmouth	Portland (C.G.).
Heroine	8	159	Corvette	Capt. F. R. Blackburne	Sept. 19, 1882	Devonport	China.
Hotspur	4	237	Armrd. turret ram	Capt. A. J. Kennedy	Re Aug. 8, 1885	Devonport	Holyhead (C.G.).
Hyacinth	8	161	Corvette	Capt. J. W. Brackenbury, C.M.G.	Jan. 27, 1886	Devonport	Pacific.
Iris	10	258	Steel despatch ves.	Capt. C. Cardale	Re. Dec. 28, 1883	Malta	Mediterranean.
Iron Duke	14	440	Armrd. brdsd. ship.	Capt. H. C. St. John	April 16, 1885	Devonport	Channel Squadron.
Jackal	2	60	P. vessel	Lt.-Com. J. W. Osborne	May 1886	Devonport	Coast of Scotland.
Kingfisher	6	139	Sloop	Com. J. H. Rainier.	Nov. 11, 1884	Sheerness	East Indies.
Leander	10	..	Corvette	Capt. M. J. Dunlop	May 29, 1885	Chatham	China.
Lily	3	..	Gun-vessel	Com. H. W. S. Gibson	Sept. 25, 1884	Devonport	N. America & W. I.
Linnet	5	82	Gun-vessel	Com. W. Marrack	Re. Jan. 7, 1886	Hong Kong	China.
Mallard	4	61	Gunboat	Lt.-Com. W. L. H. Browne	Re. Nov. 15, 1884	Bermuda	N. America & W. I.
Mariner	8	112	Sloop	Com. J. Durnford	March 19, 1885	Devonport	East Indies.
Merlin	4	61	Gunboat	Lt.-Com. W. M. Maturin.	May 3, 1883	Devonport	China.
Midge	4	78	Gun-vessel	Com. H. J. Robilliard	Dec. 11, 1883	Hong Kong	China.
Minotaur	17	709	Armrd. brdsd. ship	Capt. A. T. Bruce (V.-Ad. Sir W. Hewett, V.C.)	April 4, 1882	Portsmouth	Channel Squadron.
Miranda	6	139	Sloop	Com. E. Rooke	Re. Sept. 22, 1883	Sydney	Australia.
Mistletoe	4	22	Gunboat	Com. O. P. Tudor	August 1, 1884	Portsmouth	Channel Islands.
Monarch	7	531	Armrd. turret-ship	Capt. E. J. Church.	Sept. 15, 1885	Chatham	Channel Squadron.
Nelson	12	556	Armrd. brdsd. cr.	Capt. A. P. M. Lake (Rear-Ad. Tryon, C.B.)	Re Jan. 15, 1885	Sydney	Australia.
Neptune	6	450	Armrd. turret-ship	Capt. L. F. Jones, A.D.C.	March 28, 1883	Portsmouth	Ordered home.
Northampton	12	560	Armrd. brdsd. cr.	Capt. C. G. Fane	April 22, 1886	Portsmouth	SthamptonWtr.(C.G.)
Opal	12	203	Corvette	Capt. A. T. Brooke.	March 13, 1883	Sheerness	Australia.
Orion	4	272	Armrd. brdsd. ship.	Capt. T. H. Royse	April 27, 1885	Malta	Mediterranean.
Orwell	2	41	Gunboat	Lt.-Com. E. G. F. Law	Feb. 23, 1876	Devonport	Coast of Ireland.
Osprey	6	139	Sloop	Com. C. E. Gissing.	Sept. 19, 1882	Sheerness	East Indies.
Pegasus	6	139	Sloop	Com. A. M. Farquhar (act)	Re. Feb. 24, 1883	Hong Kong	China.
Pelican	8	139	Sloop	Com. R. W. Hope	April 3, 1884	Devonport	Pacific.
Penelope	11	357	Armrd. brdsd. ship.	Capt. J. G. Mead	May 1, 1878	Chatham	Harwich (C.G.).
Penguin	7	138	Sloop	Com. F. F. Haygarth	Jan. 27, 1886	Devonport	East Indies.
Phaeton	10	285	Corvette	Capt. R. H. Boyle	April 20, 1886	Chatham	Special service.
Polyphemus	..	132	Steel torpedo-ram	Capt. E. J. P. Gallwey	Feb. 16, 1882	Chatham	Mediterranean.
Racer	8	112	Sloop	Com. E. H. Oldham	April 9, 1885	Devonport	Cape & W. C. of Africa
Raleigh	24	555	Frigate	Capt. A. K. Wilson, V.C. (R.-Ad. Sir W. Hunt-Grubbe)	Feb. 24, 1885	Devonport	Cape & W. C. of Africa
Ranger	3	100	Gun-vessel	Com. J. P. Pipon	May 1, 1884	Suakin	East Indies.

Extract from *Army and Navy Gazette*, 3 July, 1886.

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Stations of Her Majesty's Ships in Commission—*continued.*

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned. When.	Commissioned. Where.	Stations.
Rapid	12	231	Corvette	Capt. A. J. W. Musgrave	September 9, 1884	Devonport	Australia.
Raven	1	60	Gunboat	Lt.-Com. H. L. Ross	April 25, 1883	Sheerness	Australia.
Ready	4	78	Gun-vessel	Com. Frederick Echlin	July 17, 1884	Sheerness	S. E. C. of America.
Reindeer	6	170	Sloop	Com. G. L. Atkinson	Dec. 4, 1884	Devonport	East Indies.
Rifleman	4	75	Gun-vessel	Lt.-Com. C. G. Prater	Sept. 4, 1885	Sheerness	Cape & W. C. of Africa
Rover	14	352	Corvette	Capt. Gerard Noel	Sept. 21, 1885	Chatham	Training Squadron
Royalist	12	215	Corvette	Capt. G. W. Hand	April 14, 1886	Devonport	Cape & W. C. of Africa
Ruby	12	203	Corvette	Capt. W. R. Kennedy (Senior officer on station)	April 16, 1885	Sheerness	S. E. C. of America.
Rupert	4	237	Armrd. turret ram	Capt. E. St. J. Garforth	Aug. 27, 1885	Portsmouth	Hull (C.G.).
Sapphire	12	203	Corvette	Capt. R. G. Kinahan	Jan. 18, 1883	Devonport	China.
Satellite	8	159	Corvette	Capt. A. H. Alington	April 24, 1883	Sheerness	China.
Shannon	9	342	Armrd. brdsd. ship.	Capt. C. G. F. Knowles	Aug. 5, 1885	Portsmouth	Bantry (C.G.)
Sphinx	7	91	P. vessel	Com. W. L. Morrison	October 9, 1883	Sheerness	East Indies.
Starling	4	60	Gunboat	Lt.-Com. J. B. Young	August 22, 1882	Sheerness	Mediterranean.
Stork	4	60	Gunboat	Lt.-C. A. Blennerhasset	January 2, 1883	Sheerness	S.E. C. of America.
Sultan	12	632	Armrd. brdsd. ship.	Capt. R. D. King	April 20, 1882	Portsmouth	Channel Squadron.
Superb	16	620	Armrd. brdsd. ship.	Capt. H. F. Cleveland	Re. Dec. 22, 1883	Malta	Mediterranean.
Swift	5	82	Gun-vessel	Com. A. C. B. Bromley	Re. Aug. 15, 1884	Hong Kong	China.
Swinger	4	60	Gunboat	Lt.-Com. J. L. Marx	October 2, 1883	Devonport	Australia.
Temeraire	8	531	Armoured bar ship	Capt. C. E. Domville	Re. April, 1884	Malta	Mediterranean.
Tenedos	12	203	Corvette	Capt. E. C. Drummond	Re. Dec. 14, 1882	Antigua	Devonp't (paying off).
Thalia	8	..	Corvette	Capt. Day H. Bosanquet	April, 1886	Devonport	Particular service.
Thunderer	4	400	Armrd. turret ship	Capt. H. F. Stephenson, C.B.	April 26, 1885	Malta	Mediterranean.
Triumph	14	531	Armrd. brdsd. ship.	Capt. Henry Rose (R.-Ad. Sir M. Culme-Seymour)	January 1, 1885	Portsmouth	Pacific.
Turquoise	12	231	Corvette	Capt. R. Woodward, C.B.	May 20, 1884	Sheerness	East Indies.
Vigilant	2	68	Despatch-vessel	Lt-Com. P. Hoskyns	Re. Aug. 15, 1884	Hong Kong	China.
Volage	12	337	Corvette	Capt. C. Johnstone	Sept. 21, 1885	Portsmouth	Training Squadron.
Wanderer	3	100	Sloop	Com. Orford Churchill	May 1, 1884	Sheerness	China.
Watchful	4	60	Gunboat	Lt.-Com. J. E. C. Goodrich	August 15, 1884	Devonport	Cape & W.C. of Africa.
Wild Swan	8	125	Sloop	Com. J. S. Halifax	January 22, 1885	Devonport	Pacific.
Woodlark	3	91	Gun-vessel	Com. E. W. Burt	Re. March 4, 1884	Malta	East Indies.
Wrangler	4	60	Gunboat	Lt.-Com. H. D. Law	July 14, 1885	Devonport	Cape & W.C. of Africa.
Zephyr	4	61	Gunboat	Lt.-Com. C. K. Hope	Re. Dec. 12, 1883	Hong Kong	China.

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TROOP, TRANSPORT, SUPPLY, AND SURVEYING SHIPS.

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned.		Station.
					When.	Where.	
Assistance	2	132	Troopship	Capt. J. Ingles	Re. Feb. 1, 1879	Portsmouth	Particular service.
Crocodile	3	243	Indian troopship	Capt. H. J. Carr	February, 1884	Portsmouth	Indian troop service.
Dart	2	54	Yacht	Lieut-Com. A. M. Field	Re. Nov. 15, 1885	Sydney	Australia (surveying)
Euphrates	3	243	Indian troopship	Capt. A. Paget	May 5, 1886	Portsmouth	Indian troop service.
Flora	1	51	Storeship	Com. George H. Rainier	Re. Oct. 1, 1881	C. of G. Hope	Simon's Bay.
Flying Fish	4	111	Sloop	Capt. J. F. L. P. Maclear	Re. Dec. 12, 1883	Hong Kong	China, surveying.
Harrier	..	28	Schooner	Lt-Com. F. O. Pike	Re. Jan. 14, 1885	Sydney	Australia.
Himalaya	3	223	Troopship	Capt. J. E. Stokes	December 7, 1882	Plymouth	Devonport.
Humber	1	85	Troop and storeship	Com. Arnold J. Errington	January 1, 1885	Hull	Particular service.
Jumna	3	243	Indian troopship	Capt. A. A. F. Fitz George	Re. July, 1, 1883	Portsmouth	Indian troop service.
Lark	..	35	Schooner	Lieut-Com. T. F. Pullen	Re. Jan. 14, 1885	Sydney	Australia, surveying.
Liffey	..	45	Storeship	Staff Com. F. K. Taylor	Re. Nov. 17, 1878	Coquimbo	Coquimbo.
Myrmidon	..	111	Gun-vessel	Com. R. F. Hoskyn	January 10, 1884	Sheerness	Surveying.
Orontes	2	225	Troopship	Capt. C. B. Theobald	July 3, 1883	Chatham	Special service.
Paluma	..	40	Gunboat	Lt-Com. G. E. Richards	Owned by Queensland Government.		Colonial survey. serv.
Rambler	3	111	Gun-vessel	Com. W. U. Moore	November 1884	Chatham	China, surveying.
Sea-horse	..	64	Steel tug	Staff-Capt. H. Hosken	January 20, 1881	Portsmouth	Particular service.
Serapis	3	243	Indian troopship	Capt. A. L. Douglas	Re. July 1, 1880	Portsmouth	Indian troop service.
Sparrowhawk	..	33	Schooner	Lieut-Com. C. F. Oldham	Re. Aug. 1, 1885	Bermuda	N. A. & W. I., survey.
Sylvia	4	111	Gun-vessel	Com. L. S. Dawson	Dec. 12, 1885	Malta	Surveying.
Tamar	2	..	Troopship	Capt. J. B. Warren	Oct. 21, 1882	Devonport	Particular service.
Triton	..	40	Surveying service	Staff-Com. T. H. Tizard	May 2, 1882	Sheerness	Surveying, Home Sta.
Tyne	2	135	Troopship	Com. W. E. Darwall	June 18, 1878	Chatham	Particular service.
Undine	..	34	Schooner	Lt. Com. Charles H. Cross	Re. Jan. 14, 1885	Sydney	Australia.
Urgent.	3	101	Depôt-ship	Comdre. F. M. Prattent	Re. Oct. 1, 1883	Jamaica	Jamaica.
Valorous	1	175	Frigate	Capt. Hon. R. Hare	November 1, 1882	Devonport	Particular service.
Wye	1	75	Storeship	Staff-Com. A. Thomas	Re. Nov. 12, 1885	Sheerness	Particular service.

Extract from *Army and Navy Gazette*, 3 July, 1886.

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Stations of Her Majesty's Ships in Commission—*continued.*

TRAINING AND STATIONARY SHIPS, YACHTS, AND TENDERS.

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned. When.	Commissioned. Where.	Stations.
Alberta	..	..	Yacht	Staff-Cm. W. B. Goldsmith	Tender to Victoria and Albert		Portsmouth.
Ariel	4	28	Gunboat	Lieut.-Com. H. C. Festing	Tender to Rupert		Hull.
Asia	4	271	Flagship	Capt. R. E. Tracey (Rear-Ad. F. A. Herbert)	Re. July 1, 1884	Portsmouth	Portsmouth.
Avon	4	28	Gun-vessel	Lt.-Com. C. F. Foley	Tender to Northampton		Southampton Water.
Boscawen	16	154	Boy's training-ship.	Com. the Hon. A. Littleton	Re. Jan. 1, 1877	Portsmouth	Portland.
Brilliant	8	12	Drill-ship for R.N.R.	Lieut.-Com. E. S. Evans	Re. April 1, 1881	Inverness	Inverness.
Britannia	..	177	Nav. Cdts. Schl.	Capt. N. Bowden-Smith	Re. April 1, 1880	Dartmouth	Dartmouth.
Cambridge	29	180	Gunnery-ship	Capt. G. Bosanquet	Re. April 1, 1880	Devonport	Devonport.
Castor	13	30	Drill-ship for R.N.R.	Com. Charles E. D. Wilcox	Re. April 1, 1881	North Shields	North Shields.
Cherub	2	25	Gunboat	Lieut.-Com. J. L. Burr	Tender to Hercules		Portland
Clyde	15	30	Drill-ship for R.N.R.	Com. A. W. Warry	Re. April 1, 1881	Aberdeen	Aberdeen.
Cruiser	4	91	Sailing sloop	Com. H. F. Hughes-Hallett	Re. Feb. 1, 1883	Malta	Mediterranean.
Dædalus	13	30	Drill-ship for R.N.R.	Com. C. Hawkins	Re. April 1, 1881	Bristol	Bristol
Defiance	..	..	Torp. school-ship	Com. J. Norcock	Com. Dec. 13, 1884	Devonport	Devonport.
Duke of Wellington.	25	273	Flagship	Capt. Seymour (Admiral Sir G. O. Willes, K.C.B.)	Jan. 1, 1883	Portsmouth	Portsmouth.
Duncan	31	191	Flagship	Capt. J. A. Poland (Vice-Admi. H. S. H. Prince Leiningen.)	Re. Jan. 1, 1882	Sheerness	Sheerness.
Durham	17	30	Drill-ship for R.N.R.	Com. Henry Washington	Re. April 1, 1881	Sunderland	Sunderland.
Eagle	12	31	Drill-ship for R.N.R.	Com. F. A. Wetherall	Re. April 1, 1881	Liverpool	Liverpool.
Elfin	..	..	Yacht	Staff-Com. W. P. Haynes	Tender to Victoria and Albert.		Portsmouth.
Elk	4	28	Gun-vessel	Lieut.-Com. F. L. Laurence	Tender to Devastation		Queensferry.
Enchantress	1	59	Yacht	Staff-Com. W. W. Vine	April 1, 1877	Portsmouth	Portsmouth.
Excellent	13	246	Gunnery-ship	Capt. John A. Fisher, C.B.	Re. July 1, 1884	Portsmouth	Portsmouth.
Firefly	4	25	Gunboat	Lieut.-Com. Bruce	Tender to Penelope		Harwich.
Fire Queen	..	22	Yacht	Staff-Com. J. Phillips	Tender to D. of Wellington		Portsmouth.
Firm	4	28	Gunboat	Lieut.-Com. James Brant	Tender to Devastation		Queensferry.
Forester	4	30	Gunboat	Lieut.-Com. A. Haggard	Tender to Ajax		Greenock.
Ganges	19	139	Boy's training-ship.	Com. R. H. Thornton	Re. July 1, 1884	Devonport	Falmouth.
Handy	..	..	Gunboat	Lt.-Com. J. A. Ashworth	Tender to Excellent		Portsmouth.
Hibernia	12	122	Receiving ship	Com. F. Coddington (Rr.-Ad. Hon. W. J. Ward)	Re. July 1, 1881	Malta	Malta.
Imogene	..	22	Yacht	Lieut.-Com. W. Snell	July 3, 1884	Portsmouth	Mediterranean.
Impregnable	22	193	Boy's training-ship.	Capt. H. G. Andoe	Re. July 1, 1884	Devonport	Devonport.
Indus	1	266	Flagship	Capt. H. H. Rawson, C.B. (Rear-Ad. H. D. Grant.)	July 1, 1884	Devonport	Devonport.
Liberty	8	27	Brig	Lieut.-Com. A. T. Target	Tender to Lion		Devonport.
Lion	24	186	Boy's training-ship.	Com. W. Collins	Re. July 1, 1881	Devonport	Devonport.

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Martin	10	27	Brig	Lt.-Com. E. H. Bayly	Tender to	St. Vincent	Portsmouth.
Medina	3	23	Gunboat	Staff-Com. John Edwards	Tender to	D. of Wellington	Portsmouth.
Nankin	..	39	Receiving ship.	Capt. Edward Kelly	Re. April 1, 1880	Pembroke	Pembroke Dock
Nautilus	8	27	Brig	Lt.-Com. W. H. Somerset	Tender to	Impregnable	Devonport.
Osborne	2	145	Royal yacht	Com. W. H. Fawkes	April 1, 1883	Portsmouth	Portsmouth.
Pembroke	1	57	Flagship	Capt. A. Buller, C.B., A.D.C. (Rear-Ad. W. Codrington)	Re. July 1, 1884.	Sheerness	Chatham.
Pilot	8	31	Brig	Lieut.-Com. H. F. Hay	Tender to	Impregnable	Devonport.
President	10	32	Drill-ship for R.N.R.	Com. C. Caffin	Re. April, 1, 1881	West India Docks	West India Docks.
Revenge	28	203	Flagship	Capt. R. P. Dennistoun (Rear-Ad. H. D. Hickley)	Re July 1, 1876.	Queenstown	Queenstown.
Royal Adelaide.	13	268	Flagship	Capt. W. H. Cuming (Ad. Augustus Phillimore)	Re. Jan. 1, 1881.	Devonport	Devonport.
St. Vincent	22	172	Boy's training-ship	Com. R. F. H. Henderson	Re. July 1, 1884.	Portsmouth	Portsmouth.
Seaflower	8	27	Brig	Lieut.-Com. Rolleston	Tender to	Boscawen	Portland.
Sealark	8	27	Brig	Lieut.-Com. P. C. Underwood	Tender to	Ganges	Devonport.
Sprightly	2	23	P. vessel	Staff Com. H. E. Wood	Tender to	D. of Wellington	Portsmouth.
Tay	3	23	Gunboat	Lieut.-Com. Thompson	Tender to	Hotspur	Holyhead.
Terror	8	67	Receiving ship	Capt. John F. C. Grant	Re. Jan. 1, 1880.	Bermuda.	Bermuda
Trent	3	23	Gunboat	Lieut.-Com. J. Casement.	Tender to	Duncan	Sheerness.
Trincomalee	15	33	Drill-ship for R.N.R.	Com. F. Edwards	Re. April 1, 1881	..	Southampton Water.
Unicorn	10	30	Drill-ship for R.N.R.	Com. W. H. G. Nowell	Re. April 1, 1881	Dundee	Dundee.
Vernon	..	202	Torpedo school ship	Capt. Samuel Long	Re. Jan. 1, 1884.	Portsmouth	Portsmouth.
Vesuvius	..	..	Torpedo vessel	Lieut.-Com. H. B. Jackson	Tender to	Vernon	Portsmouth.
Victor Emanuel	2	141	Receiving ship	Comdre. G. D. Morant	Re. Feb. 1884	Malfa	Hong Kong.
Victoria & Albert	2	151	P. royal yacht	Capt. J. R. Fullerton	Re July 1, 1880.	Portsmouth	Portsmouth.
Victory	26	52	Tender to Duke of Wellington				Portsmouth.
Vivid	1	23	P. vessel	Staff Com. T. Robertson	Tender to	Royal Adelaide	Devonport.
Wave	..	..	Yacht	Lieut.-Com. W. L. Bignold	Tender to	Brittannia	Dartmouth.

Stations of the Royal Marine Forces.

Division.	No. Cos.	Commanding Officer.	Second in Command.	Station.
Artillery	16	Col. George Brydges	Col. Sir F. W. Festing, K.C.M.G., C.B., A.D.C.	Eastney, near Portsmouth.
Light Infantry—				
Chatham	16	Col. S. J. Graham, C.B.	Lieut.-Col. A. H. F. Barnes	Chatham.
Portsmouth	16	Col. H. S. Jones, C.B., A.D.C.	Col. J. Cairncross	Forton Barracks, Gosport.
Plymouth	16	Col. F. G. Le Grand	Col. P. R. Holmes	Plymouth.
Depôt—Walmer	4	Col. G. F. Munro		Walmer.

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List of Parliamentary Papers relating to Naval Affairs.

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The above Papers can be purchased from Messrs. Hansard & Co., 13, Great Queen Street, Lincoln's Inn Fields.

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Dockyard Expense Accounts.

SHIPBUILDING AND DOCKYARD TRANSACTIONS FOR THE YEAR 1884-85.

REPORT of the ACCOUNTANT-GENERAL of the NAVY and COMPTROLLER of NAVY PAY.

Admiralty, S.W., 10 *May*, 1886.

I BEG leave to submit herewith the Dockyard Expense Account for the year 1884–85, which has been prepared in the abridged form approved by their Lordships last year.

I am of opinion, however, that there is room for further improvement in the direction of simplicity, and have instructed the Inspector of Yard Accounts to consider in what way this can most readily be effected.

In accordance with the practice of former years, the course of expenditure on the fleet is illustrated by tables, which include the important statements appearing in the Account for 1879–80.

As regards the cost of new construction at the Dockyards, for armoured vessels the estimated cost of labour was £343,799: and the actual expenditure £369,759; and that for unarmoured construction, the estimate was £197,403, and the actual expenditure £224,451. Thus there was an excess of expenditure for labour on construction over estimate of £53,008. Comparing these figures with those of previous years, the gradual increase of expenditure on construction since 1879–80 is still maintained, as is indicated by the following table, which exhibits the cost of labour for each year between 1879–80 and 1884–85.

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The figures are as follows:—

—	Expenditure.	Excess over Estimate.	—	Expenditure.	Excess over Estimate.
	£	£		£	£
1879–80 . .	401,696	31,096	1882–83 . .	565,424	65,402
1880–81 . .	451,039	60,811	1883–84 . .	578,706	74,047
1881–82 . .	527,928	50,615	1884–85 . .	594,210	53,008

In regard to contract construction, 1884–85, there was an expenditure of £309,563, against an estimate of £309,750. Of this sum, £178,595 was for the construction of the armoured ship Benbow, and the rest for torpedo boats and unarmoured vessels.

The expenditure upon machinery for armoured vessels amounted to £290,249 for the year, against an estimate of £271,650, and helped to provide machinery for ten ironclads. Upon unarmoured vessels the expenditure was £162,946, against an estimate of £175,480.

The total cost of construction for 1884–45, including all charges for labour, materials, machinery, and miscellaneous expenditure, such as gun mountings and torpedo work, amounted to £2,242,070. If the charge for incidental or establishment expenditure is added, namely, £268,643, the final total will be £2,510,713.

The force of these figures is very striking, providing as they do a financial illustration of the result of maintaining firmly the policy established in the year 1879, when the necessity of keeping the expenditure within the estimate was subordinated to the more exacting necessity of completing the Controller's programme. As no provision is made for unforeseen work, it follows necessarily that unforeseen work becomes an additional charge, requiring provision during the year, and finding its expression in an excess at the end of the year. The result as regards the Navy is that the expenditure on new ships is a third more than it was five years ago, and that the expenditure for labour alone on them is at the rate of £600,000 instead of £400,000 a year. But the point most worthy of notice in illustration of the effects of this policy is that the amount of the excess expenditure, which is £334,979 for these six years, should represent a gain to the fleet which, under former arrangements, could not presumably have been secured.

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It may here be stated that the cost of turning out a completed ship has much increased during the last sixteen years.

—	Total Expenditure on Construction.	Total Average Cost per Ton of Work turned out during the Year.
	£	£ s. d.
1884–85.	2,242,070	109 14 2
1883–84.	1,930,090	99 14 9
1880–81.	1,426,349	84 15 11
1877–78 (Vote of Credit Year). . . .	2,922,442	80 14 2
1873–74.	1,290,028	87 14 7
1869–70.	1,387,047	55 2 0

This can be seen more accurately from a comparison for labour only, as materials vary considerably in different years.

—	Armoured Ships. Average Cost per Ton, Labour only.	Unarmoured Ships. Average Cost per Ton, Labour only.	—	Armoured Ships. Average Cost per Ton, Labour only.	Unarmoured Ships. Average Cost per Ton, Labour only.
	£ s. d.	£ s. d.		£ s. d.	£ s. d.
1878–79 . .	30 0 3	—	1882–83 . .	32 18 9	40 1 5
1879–80 . .	31 4 1	34 0 3	1883–84 . .	33 6 10	40 5 11
1880–81 . .	31 19 5	36 16 1			
1881–82 . .	32 12 3	37 16 6	1884–85 . .	34 10 11	40 19 11

It appears from this statement that to construct 10,000 tons of armoured and 5000 tons of unarmoured tonnage would cost, for labour only, about £80,000 more in 1884–85 than in 1878–79; and, further that the chief cause of increase of cost arises on the building of unarmoured ships.

It is to be observed that modern ships are fitted in a much more elaborate manner than their predecessors, carrying torpedoes, electric lights, machine guns, and a large number of mechanical appliances and auxiliary engines; but that the weight of these fittings, &c., is small compared with their cost.

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The rapid though gradual progress which has been made in the cost of naval construction can best be illustrated by the following Table, which includes the estimated expenditure for the years 1885–86 and 1886–87.

Year.	Dockyard.	Contract.	Machinery.	Total.
	£	£	£	£
1880-81 . . .	891,388	235,920	299,041	1,426,349
1881-82 . . .	1,149,718	292,243	240,539	1,682,500
1882-83 . . .	1,173,816	301,159	292,039	1,767,014
1883-84 . . .	1,186,793	235,913	507,384	1,930,090
1884-85 . . .	1,333,607	449,421	459,042	2,242,070
1885-86*. . .	*1,313,000*	*1,022,000*	*760,000*	*3,095,000*
1886-87*. . .	*1,497,927*	*1,430,200*	*746,000*	*3,656,127*

* Estimated, as shown in the programme of construction in the Estimates for these years.

I may here state that, in accordance with the decision of their Lordships, and as a final result of the tonnage controversy, tons are now omitted from the programme in the Estimates for 1886–87; but, for the sake of convenience and for purpose of comparison, the tables which appeared in the Report on the Account for 1878–80 are still retained, and will be found at page 440. Taken with reserve, and used as a rough test of work on new construction, they are not without a certain value: they cannot, however, be regarded as authoritative.

A new class of expenditure has recently arisen on account of naval construction, in the provision for gun mountings, made under Vote 10, Section 2, Sub-head L. In 1884–85, the expenditure under this head amounted to £164,989. An idea may be formed of the rapidly-increasing importance of this branch of expenditure by a reference to the Estimates for 1885–86 and 1886–87, which provide respectively £308,900 and £486,400 for this Service.

Upon reference to page 438, a Table will be found showing the progress of dockyard expenditure generally since 1869–70, which illustrates clearly the large increase which has recently been established. This may, however, be still more forcibly illustrated by the following Table, which compares the relative growth of the increase on the effective Votes for the Navy since 1879–80, with the increase on new construction. The result is so far satisfactory, that it establishes the fact that the increase may throughout be attributed almost wholly to new construction.

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Year.	Expenditure on			
	New Construction.		Total Effective Service.	
	Amount.	Increase or Decrease on preceding Year.	Amount.	Increase or Decrease on preceding Year.
	£	£	£	£
1879-80 . . .	1,388,607	—	8,196,075	—
1880-81 . . .	1,426,349	37,742	8,055,875	*140,200*
1881-82 . . .	1,682,500	256,151	8,363,392	307,517
1882-83 . . .	1,767,014	84,514	8,594,373	230,981
1883-84 . . .	1,930,090	163,076	8,436,845	*157,528*
1884-85 . . .	2,242,070	311,980	8,834,753	397,908
1885-86*. . .	3,544,524	1,302,454	10,418,000	1,583,247

* Estimated.
Note.—Increases in Roman figures. Decreases in *Italic* figures.

The expenditure on repairs and alterations does not invite this year any remarks of a special nature; but the figures given in these accounts serve, if taken over a series of years, to indicate not only the length of time occupied by this work, but its costliness.

Since 1879-80 the principal cost of the repairs and alterations of armoured vessels is shown in the Table on page 437.

It may be noted that the expenditure on the Alexandra was for repairing injuries incurred at bombardment of Alexandria.

As regards incidental charges it is worthy of note that, while the productive expenditure and the employment of labour have largely increased, they have not increased at all proportionately, as is shown by the following Table:—

—	Expenditure on Ships.			Incidental Charges.	Percentage of Incidentals on direct Charges to Ships.
	Dockyard Construction.	Repair.	Total.		
	£	£	£	£	
1879-80 . .	892,403	822,220	1,714,623	529,493	30
1880-81 . .	957,492	841,710	1,799,202	522,933	29
1881-82 . .	1,280,873	691,080	1,971,953	513,773	26
1882-83 . .	1,342,161	877,697	2,219,858	524,948	23
1883-84 . .	1,563,884	926,179	2,490,063	549,442	22
1884-85 . .	1,711,477	1,014,813	2,726,290	572,402	21

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The value of these figures as an illustration of the course of dockyard expenditure and of the influence of the attempt made five years ago to check the incidental or non-productive expenditure, is manifest. In spite of the large increase of productive expenditure from £1,714,623 in 1879–80 to £2,726,290 in 1884–85, the non-productive expenditure shows a reduction as compared with it of from 30 per cent. in 1879–80 to 21 per cent. in 1884–85.

Although this decrease is in a measure due to ships being charged with expenditure formerly brought to account under the heads of incidental expenditure, by far the larger portion may undoubtedly be taken credit for as a real saving.

A branch of dockyard expenditure which demands more attention than seems to have been given to it of recent years, is the cost of buildings under Vote 11.

Upon reference to page 442, a table will be found comprising the expenditure for the last eight years at the six principal dockyards.

In this period the value of buildings and machinery has increased by £435,410 in the case of buildings, and by £223,230 in the case of machinery; whereas the total additional expenditure on new buildings and machinery between the above periods is—

	£
For building . . .	1,317,310
For machinery . . .	223,230

As a basis of valuation, it was decided many years ago to calculate depreciation at the rate of one per cent. per annum in the case of buildings, but no depreciation is allowed in calculating the value of machinery. This result is hardly satisfactory in either case, and is open, I submit, to reconsideration.

During the same period a sum of £499,605 has been spent on repair of buildings, &c., or about five-eighths per cent. per annum on their assumed value, and £374,491 on repair of machinery, or about four per cent. per annum on its assumed value.

G. FITZGERALD,
Accountant-General of the Navy.

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PRINCIPAL COST of the REPAIRS and ALTERATIONS of ARMOURED VESSELS, since 1879–80.

SHIP.	1879–80.	1880–81.	1881–82.	1882–83.	1883–84.	1884–85.	Total.
	£	£	£	£	£	£	£
Hotspur . .	51,790	48,729	5,361	7,252	—	—	113,132
Devastation . .	46,291	3,737	—	—	—	—	50,028
Sultan . .	41,513	12,386	8,025	—	—	6,861	68,785
Swiftsure . .	24,974	23,894	10,435	—	—	—	59,303
Audacious . .	16,001	12,340	32,801	39,947	—	—	101,089
Bellerophon .	—	28,935	13,259	—	11,340	15,893	69,427
Minotaur . .	—	6,520	23,168	8,286	..	15,031	53,005
Monarch . .	—	—	8,821	—	4,655	—	13,476
Achilles . .	—	13,056	4,998	9,183	4,966	8,650	40,853
Alexandra . .	—	—	—	15,261	3,891	9,324	28,476
Shannon . .	—	—	—	34,321	3,446	—	37,767
Rupert . .	—	—	—	30,014	4,497	—	34,511
Agincourt . .	3,530	3,742	4,407	12,081	2,700	11,286	37,746
Black Prince .	23,260	—	—	—	—	43,834	67,094
Triumph . .	—	—	—	—	35,170	28,997	64,167
Iron Duke . .	2,613	6,092	—	—	57,375	13,862	79,942
Polyphemus .	—	—	—	10,911	7,168	16,631	34,710
Temérnire . .	1,818	1,761	—	2,227	—	23,003	28,809

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STATEMENT showing the Cost of Construction, Repairs and Maintenance, and by Contract during the Years

YEAR.	TONS BUILT (WEIGHT OF HULL).					EXPENDITURE FOR LABOUR AND				
	Dockyard.		Contract.			Construction.				
						Dockyard-built Vessels.		Contract-built Vessels.		
	Armoured.	Unarmoured.	Armoured.	Unarmoured.	Total.	Armoured.	Unarmoured.	Armoured.	Unarmoured.	Total.
1869-70	10,632	2,994	10,828	719	25,173	536,293	259,906	540,055	50,793	1,387,047
1870-71	9,567	3,942	6,395	627	20,531	558,800	264,052	455,415	52,547	1,330,814
1871-72	6,261	7,167	7,659	371	21,458	345,750	448,074	349,288	41,060	1,184,172
1872-73	5,789	6,632	564	1,546	14,531	237,956	413,878	61,869	95,384	809,087
1873-74	5,003	6,317	—	3,384	14,704	377,715	615,128	8,244	288,941	1,290,028
1874-75	7,916	3,388	541	4,635	16,480	710,236	372,023	31,928	413,974	1,528,161
1875-76	10,641	3,516	3,635	1,924	19,716	759,495	289,606	298,968	265,149	1,613,218
1876-77	7,920	5,517	3,528	7,265	24,230	604,607	497,506	335,711	684,136	2,121,960
1877-78*	5,940	6,112	1,173	3,338	16,563	408,433	421,897	1,540,039	552,073	2,922,442
1878-79	6,912	4,759	1,518	4,743	17,932	372,679	353,504	258,516	523,350	1,508,049
1879-80	7,189	5,215	238	2,585	15,227	528,471	363,932	103,253	392,951	1,388,607
1880-81	9,235	4,233	—	3,353	16,821	648,017	309,475	50,781	418,076	1,426,349
1881-82	10,748	4,690	—	3,172	18,610	938,641	342,232	10,672	390,955	1,682,500
1882-83	11,372	4,763	192	3,590	19,917	961,151	381,010	29,559	395,294	1,767,014
1883-84	11,714	4,644	1,222	1,771	19,351	1,127,377	436,507	132,760	233,446	1,930,090
1884-85	10,704	5,475	2,218	2,040	20,437	1,283,899	427,578	233,828	296,765	2,242,070

* The number of tons built by contract in this year does not include 14,808 tons of armoured, and 4[illegible] of unarmoured vessels, purchased out of the Vote of Credit; but their cost is included in the sums £1,540,039, and £552,073, under the head of expenditure on contract construction for this year.

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and INCIDENTAL CHARGES, also TONS (Weight of Hull) built in DOCKYARDS 1869–70 to 1884–85 inclusive.

MATERIALS ON			TOTAL EXPENDITURE ON SHIPS.			TOTAL AMOUNT EXPENDED UNDER VOTE.	
REPAIR AND MAINTENANCE.							
Armoured.	Unarmoured.	TOTAL.	Direct — For Labour and Materials, including Payments to Contractors, &c.	Indirect — For Dockyard Incidental Charges.	TOTAL.	Votes 6 and 10, for Labour and Stores, &c.	Navy Votes.
130,743	446,549	577,292	1,964,339	491,104†	2,455,443	2,572,745	10,102,641
182,065	487,551	669,616	2,000,430	499,902†	2,500,332	2,635,076	10,087,414
87,595	397,342	484,937	1,669,109	436,102	2,105,211	2,545,865	9,875,981
158,933	386,983	545,916	1,355,003	416,888	1,771,891	2,413,347	9,564,678
291,381	524,601	815,982	2,106,010	483,398	2,589,408	3,175,631	10,558,751
320,229	672,570	992,799	2,520,960	490,419	3,011,379	3,455,650	10,776,277
321,871	631,806	953,677	2,566,895	530,179	3,097,074	3,540,092	10,903,924
207,446	600,210	807,656	2,929,616	509,973	3,439,589	3,929,846	11,259,835
489,182	580,243	1,069,425	3,991,867	521,034	4,512,901	5,123,591	12,800,044
430,077	634,074	1,064,151	2,572,200	566,516	3,138,716	3,810,737	11,959,139
331,033	491,187	822,220	2,210,827	529,493	2,740,320	3,106,563	11,004,394
259,987	581,723	841,710	2,268,059	522,933	2,790,992	3,082,803	10,513,469
212,288	478,792	691,080	2,373,580	513,773	2,887,353	3,318,555	10,870,922
321,979	555,718	877,697	2,644,711	524,948	3,169,659	3,472,953	12,063,210
266,497	659,682	926,179	2,856,269	549,442	3,405,711	3,615,264	10,758,594
328,270	686,543	1,014,813	3,256,883	572,402	3,829,285	3,861,333	11,625,809

† These amounts are based upon the average indirect expenses for 1871–72 and 1872–73.

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STATEMENT showing Calculated and Actual Tons (Weight of Hull) Completed on ARMOURED VESSELS during the Years 1869–70 to 1884–85 inclusive.

	NUMBER OF TONS (WEIGHT OF HULL) OF ARMOURED VESSELS.			
	Completed.		More.	Less.
	Calculated.	Actual.		
1869–70 . . .	10,632	8,652	—	1,980
1870–71 . . .	9,567	8,673	—	894
1871–72 . . .	6,261	6,335	74	—
1872–73 . . .	5,789	5,065	—	724
1873–74 . . .	5,003	4,016	—	987
1874–75 . . .	7,916	6,669	—	1,247
1875–76 . . .	10,641	8,307	—	2,334
1876–77 . . .	7,920	7,060	—	860
1877–78 . .	5,940	5,020	—	920
1878–79 . .	6,912	6,321	—	591
1879–80 . . .	7,189	6,048	—	1,141
1880–81 . . .	9,235	7,860	—	1,375
1881–82 . . .	10,748	9,095	—	1,653
1882–83 . . .	11,372	9,977	—	1,395
1883–84 . . .	11,714	10,793	—	921
1884–85 . . .	10,704	10,576	—	128
	137,543	120,467	74	17,150

Net less . . . . . 17,076 tons.

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STATEMENT showing Proposed and Completed TONS of ARMOURED and UNARMOURED VESSELS built in DOCKYARDS and by CONTRACT during the Years 1869-70 to 1884-85 inclusive.

	TONS (WEIGHT OF HULL) BUILT.											
	Dockyard.				Contract.				Total.			
	Proposed.	Completed.	More.	Less.	Proposed.	Completed.	More.	Less.	Proposed.	Completed.	More.	Less.
1869-70 . . .	13,735	13,626	—	127	9,193	11,547	2,354	—	22,946	25,173	2,227	—
1870-71 . . .	14,777	13,509	—	1,268	8,868	7,022	—	1,846	23,645	20,531	—	3,114
1871-72 . . .	14,214	13,428	—	786	7,065	8,030	965	—	21,279	21,458	179	—
1872-73 . . .	14,552	12,421	—	2,131	3,456	2,110	—	1,346	18,008	14,531	—	3,477
1873-74 . . .	13,328	11,320	—	2,008	4,186	3,384	—	802	17,514	14,704	—	2,810
1874-75 . . .	14,174	11,304	—	2,870	5,623	5,176	—	447	19,797	16,480	—	3,317
1875-76 . . .	13,812	14,157	345	—	5,853	5,559	—	294	19,665	19,716	51	—
1876-77 . . .	13,497	13,437	—	60	10,265	10,793	528	—	23,762	24,230	468	—
1877-78 . . .	14,240	12,052	—	2,188	4,408	4,511	103	—	18,648	16,563	—	2,085
1878-79 . . .	13,408	11,671	—	1,737	6,360	6,261	—	99	19,768	17,932	—	1,836
1879-80 . . .	12,151	12,404	253	—	3,127	2,823	—	304	15,278	15,227	—	51
1880-81 . . .	12,353	13,468	1,115	—	4,103	3,353	—	750	16,456	16,821	365	—
1881-82 . . .	14,840	15,438	598	—	4,050	3,172	—	878	18,890	18,610	—	280
1882-83 . . .	15,502	16,135	633	—	4,640	3,782	—	858	20,142	19,917	—	225
1883-84 . . .	15,172	16,352	1,186	—	4,252	2,993	—	1,259	19,424	19,351	—	73
1884-85 . . .	16,055	16,179	124	—	4,624	4,258	—	366	20,679	20,437	—	242
							Total . . .		315,091	301,681	3,290	17,510
							Net Less . . .		14,220 tons.			

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ADDITIONS and REPAIRS to BUILDINGS and MACHINERY at HER MAJESTY'S DOCKYARDS during the eight years 1877–78 to 1884–85 inclusive.

The figures in *Italics* represent expenditure for Dredging.

YEAR.	BUILDINGS.		MACHINERY.	
	Additions. Expenditure.	Repairs. Expenditure.	Additions. Expenditure.	Repairs. Expenditure.
	£	£	£	£
1877–78 . .	158,020	50,496 *22,401*	32,646	44,643
1878–79 . .	202,350	52,052 *20,786*	25,531	46,967
1879–80 . .	210,350	54,005 *28,930*	31,285	47,003
1880–81 . .	215,110	62,164 *18,334*	24,181	45,943
1881–82 . .	177,020	65,340 *21,988*	26,437	48,454
1882–83 . .	120,610	71,797 *27,320*	19,424	44,665
1883–84 . .	120,000	72,078 *25,368*	35,178	48,445
1884–85 . .	113,850	71,093 *25,108*	28,507	48,371

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SHIPS BUILDING AND COMPLETING FOR SEA SERVICE.

EXPENDITURE IN 1884-85.

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No. 1.—Ships Building and

Note.—The Figures printed in *Italics* show

DESCRIPTION.	Dockyard, &c. at which the Expense has been incurred.	EXPENDITURE INCURRED AND — HULL. Value of Materials (Net).	HULL. Wages.	HULL. Payments to Contractors, &c., Made and Allowed at the Admiralty.	MACHINERY. (Engines, Boilers, and Engineers' Fittings.) Value of Materials (Net).	MACHINERY. Wages.	MACHINERY. Payments to Contractors, &c. Made and Allowed at the Admiralty.
		£	£	£	£	£	£
BUILDING, &c.: Armoured Ships. Built by Contract	Chatham	6	21	—	91	—	—
	Portsmouth	17	34	—	72	75	—
	Other than H.M. Yards.	—	—	198,129	—	—	32,832
	Total . £	23	55	198,129	163	75	32,832
Armoured Ships. Built in Her Majesty's Dockyards.	Chatham	191,007	107,660	—	2,588	7,321	130,816
	Portsmouth	176,471	129,422	—	3,623	11,949	67,017
	Devonport	699	2,238	—	*33*	1,084	—
	Pembroke	207,795	105,083	—	324	329	60,316
	Other than H.M. Yards.	—	—	52,877	—	—	4,290
	Total . £	575,972	344,403	52,877	6,502	20,683	262,439
Unarmoured Ships. Built by Contract	Chatham	2,261	6,420	—	1,178	3,065	900
	Sheerness	636	1,928	—	73	199	—
	Portsmouth	1,525	4,574	—	1,218	1,665	—
	Devonport	688	2,019	—	50	310	—
	Other than H.M. Yards.	—	—	148,972	—	—	96,744
	Total . £	5,110	14,941	148,972	2,519	5,239	97,644
Unarmoured Ships. Built in Her Majesty's Dockyards.	Chatham	27,329	66,020	—	1,046	2,937	23,660
	Sheerness	11,670	25,310	—	220	610	7,000
	Portsmouth	6,360	16,098	—	1,344	2,032	5,140
	Devonport	26,481	53,319	—	757	2,472	12,385
	Pembroke	19,069	22,590	—	155	71	10,916
	Malta	2,302	1,237	—	1,361	345	—
	Other Foreign Yards.	124	196	—	5	10	—
	Other than H.M. Yards.	—	—	44,491	—	—	4,854
	Total . £	93,335	184,770	44,491	4,888	8,477	63,955
Steam Tugs, Yard Craft, &c	Chatham	98	390	—	10	33	—
	Portsmouth	168	346	—	19	35	17
	Devonport	28	52	—	67	163	—
	Malta	3	38	—	—	—	—
	Other Foreign Yards.	1,159	837	—	—	—	—
	Other than H.M. Yards.	—	—	4,900	—	—	—
	Total . £	1,400	1,663	4,900	96	231	17
TOTAL, No. 1	Chatham	220,701	180,511	—	4,913	13,356	185,376
	Sheerness	12,306	27,238	—	293	809	7,000
	Portsmouth	184,541	150,474	—	6,276	15,756	72,174
	Devonport	27,840	57,628	—	841	4,029	12,385
	Pembroke	226,864	127,673	—	479	400	71,232
	Malta	2,305	1,275	—	1,361	345	—
	Other Foreign Yards.	1,283	1,033	—	5	10	—
	Other than H.M. Yards.	—	—	449,369	—	—	138,720
	Total . £	675,840	545,832	449,369	14,168	34,705	456,887

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COMPLETING FOR SEA SERVICE.

the Amount of Net Credits for Stores, &c. returned.

BROUGHT TO ACCOUNT IN THE YEAR 1884–85.

OTHER FITTINGS, STORES, &c. (MASTS, RIGGING, STORES, ELECTRIC APPARATUS, &c.).			TOTAL.				Incidental and Establishment Charges.	Total Expense, inclusive of Incidental and Establishment Charges.
Value of Materials (Net).	Wages.	Payments to Contractors, &c., Made and Allowed at the Admiralty.	Value of Materials (Net).	Wages.	Payments to Contractors, &c., Made and Allowed at the Admiralty.	TOTAL.		
£	£	£	£	£	£	£	£	£
2,543	8	—	2,640	29	—	2,669	156	2,825
—	—	—	89	109	—	198	43	241
—	—	—	—	—	230,961	230,961	—	230,961
2,543	8	—	2,729	138	230,961	233,828	199	234.027
3,383	1,717	—	196,978	116,758	130,816	444,552	62,924	507,476
7,089	2,108	—	187,183	143,479	67,017	397,679	62,396	460,075
2,249	575	—	2,915	3,897	—	6,812	2,138	8,950
1,710	75	—	209,829	105,487	60,316	375,632	30,365	405,997
—	—	2,057	—	—	59,224	59,224	—	59,224
14,431	4,535	2,057	596,905	369,621	317,373	1,283,899	157,823	1,441,722
4,224	2,328	—	7,663	11,813	900	20,376	5,735	26,111
2,664	429	—	3,373	2,556	—	5,929	1,605	7,534
4,384	261	—	7,127	6,500	—	13,627	2,763	16,390
709	336	—	1,447	2,665	—	4,112	1.466	5,578
—	—	150	—	—	245,866	245,866	—	245,866
11,981	3,354	150	19,610	23,534	246,766	289,910	11,569	301,479
2,886	797	—	31,261	69,754	23,660	124,675	32,888	157,563
3,825	1,039	—	15,715	26,959	7,000	42,674	15,484	65,158
3,960	794	—	11,664	18,924	5,140	35,728	7,687	43,415
9,275	3,000	—	36,513	58,791	12,385	107,689	31,658	139.347
13	20	—	19,237	22,681	10,916	52,834	6,237	59,071
—	—	—	3,663	1,582	—	5,245	1,370	6,615
2	10	—	131	216	—	347	602	949
—	—	—	—	—	49,345	49,345	—	49,345
19,961	5,660	—	118,184	198,907	108,446	425,537	95,926	521,463
211	94	—	319	517	—	836	252	1,088
161	9	—	348	390	17	755	159	914
101	13	—	140	228	—	368	129	497
—	—	—	3	38	—	41	19	60
—	—	—	1,159	837	—	1,996	2,567	4,563
—	—	—	—	—	4,900	4,900	—	4,900
473	116	—	1,969	2,010	4,917	8,896	3,126	12,022
13,247	5,004	—	238,861	198,871	155,376	593,108	101,955	695,063
6,489	1,468	—	19,088	29,515	7,000	55,603	17,089	72,692
15,594	3,172	—	206,411	169,402	72,174	447,987	73,048	521,035
12,334	3,924	—	41,015	65,581	12,385	118,981	35,391	154,372
1,723	95	—	229,066	128,168	71,232	428,466	36,602	465,068
—	—	—	3,666	1,620	—	5,286	1,389	6,675
2	10	—	1,290	1,053	—	2,343	3,169	5,512
—	—	2,207	—	—	590,296	590,296	—	590,296
49,389	13,673	2,207	739,397	594,210	908,463	2,242,070	268,643	2,510,713

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No. 2.—Wear and Tear and Maintenance of the Fleet, in Commission rendered necessary by

Note.—The Figures printed in *Italics* show

DESCRIPTION.	EXPENDITURE INCURRED AND					
	HULL.			MACHINERY. (Engines, Boilers, and Engineers' Fittings.)		
	Value of Materials (Net).	Wages.	Payments to Contractors, &c., Made and Allowed at the Admiralty.	Value of Materials (Net).	Wages.	Payments to Contractors, &c., Made and Allowed at the Admiralty.
IN COMMISSION:	£	£	£	£	£	£
Armoured Ships:						
Built by Contract . . .	12,887	20,649	4,293	5,368	9,656	—
Built in Her Majesty's Dockyards.	9,107	19,276	9,615	8,510	10,150	14
Unarmoured Ships . . .	29,650	61,441	28,524	12,764	30,627	4,127
Total in Commission . .	51,644	101,366	42,432	26,642	50,433	4,141
IN RESERVE:						
Armoured Ships:						
Built by Contract . . .	7,574	24,865	3,213	3,120	10,240	700
Built in Her Majesty's Dockyards.	3,054	10,873	15,307	*926*	3,928	300
Unarmoured Ships . . .	40,013	117,924	26,290	14,636	45,872	7,172
Total in Reserve . .	50,641	154,662	44,810	16,830	60,840	8,172
Hulks, Repairing, &c. . . .	1,006	2,852	2,243	194	56	—
Steam Tugs, &c., Repairing, &c. .	3,870	10,472	1,529	6,032	7,247	1,123
TOTAL for Ships in Commission and Reserve.	107,161	268,352	91,014	49,698	117,776	13,436

No. 3.—Ships and

TOTAL, No. 3 . . .	*954*	—	296	*337*	—	10

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and in RESERVE, including REPAIRS, REFITS, ALTERATIONS, WORKS NEW ARMAMENTS, &c.

the Amount of Net Credits for Stores, &c. returned.

BROUGHT TO ACCOUNT IN THE YEAR 1884-85.								
OTHER FITTINGS, STORES, &c. (MASTS, RIGGING, STORES, ELECTRIC APPARATUS, &c.)			TOTAL.				Incidental and Establishment Charges.	Total Expense, inclusive of Incidental and Establishment Charges.
Value of Materials (Net).	Wages.	Payments to Contractors, &c., Made and Allowed at the Admiralty.	Value of Materials (Net).	Wages.	Payments to Contractors, &c., Made and Allowed at the Admiralty.	TOTAL.		
£	£	£	£	£	£	£	£	£
49,355	3,535	333	67,610	33,840	4,626	106,076	31,180	137,256
35,649	3,009	1,282	53,266	32,435	10,911	96,612	21,041	117,653
140,853	11,762	4,676	183,267	103,830	37,327	324,424	103,606	428,030
225,857	18,306	6,291	304,143	170,105	52,864	527,112	155,827	682,939
26,032	3,510	320	36,726	38,615	4,233	79,574	22,857	102,431
12,159	1,261	52	14,287	16,062	15,659	46,008	9,155	55,163
54,300	12,851	853	108,949	176,647	34,315	319,911	94,202	414,113
92,491	17,622	1,225	159,962	231,324	54,207	445,493	126,214	571,707
887	216	2	2,087	3,124	2,245	7,456	2,641	10,097
4,893	565	6	14,795	18,284	2,658	35,737	19,003	54,740
324,128	36,709	7,524	480,987	422,837	111,974	1,015,798	303,685	1,319,483
VESSELS, &c., BREAKING UP.								
--	—	—	*1,291*	—	306	*985*	74	*911*

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VALUE of LAND, also BUILDINGS, including SLIPS, BASINS, STOREHOUSES, &c., and MANUFACTURING SHOPS; also Value of PLANT (Machinery), on the 31st March, 1884 and 31st March, 1885.

HOME YARDS.

		Value on 31st March, 1884.	Value on 31st March, 1885.			Value on 31st March, 1884.	Value on 31st March, 1885.
		£	£			£	£
Chatham	Land	253,330	253,330	Chatham	Machinery	343,820	354,902
	Buildings	2,472,070	2,461,900				
Sheerness	Land	4,525	4,525	Sheerness	„	96,125	96,641
	Buildings	909,780	901,580				
Portsmouth	Land	112,730	113,750	Portsmouth	„	325,312	331,295
	Buildings	3,901,870	3,890,500				
Devonport	Land	89,800	89,800	Devonport	„	372,594	380,510
	Buildings	2,573,000	2,573,000				
Pembroke	Land	3,110	3,110	Pembroke	„	108,250	111,260
	Buildings	651,620	649,160				
Haulbowline	Land	1,450	1,450	Haulbowline	„	1,528	1,528
	Buildings	516,000	549,700				
Total	Land £	464,945	465,965				
	Buildings £	11,024,340	11,025,840		£	1,247,629	1,276,136

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Foreign Yards.

		Value on 31st March, 1884.	Value on 31st March, 1885.
		£	£
Antigua	Land	90	90
	Buildings	33,890	33,200
Bermuda	Land	6,138	6,138
	Buildings	478,050	469,020
Cape of Good Hope	Land	14,000	14,000
	Buildings	41,450	42,820
Esquimalt	Land	1,200	1,200
	Buildings	12,980	12,720
Gibraltar	Land	56,000	56,000
	Buildings	102,740	100,800
Halifax	Land	19,600	19,600
	Buildings	68,650	67,280
Hong Kong	Land	3,375	3,375
	Buildings	31,050	31,110
Jamaica	Land	2,500	2,500
	Buildings	15,060	14,760
Kowloon	Land	1,187	1,187
	Buildings	9,700	9,500
Malta	Land	50,017	50,017
	Buildings	425,600	450,620
Trincomalee	Land	300	300
	Buildings	33,280	32,830
Total	Land £	154,407	154,407
	Buildings £	1,252,450	1,264,740

		Value on 31st March, 1884.	Value on 31st March, 1885.
		£	£
Antigua	Machinery	562	572
Bermuda	„	25,481	26,421
Cape of Good Hope	„	5,236	5,319
Esquimalt	„	2,555	2,555
Gibraltar	„	13,672	13,677
Halifax	„	4,369	4,572
Hong Kong and Kowloon	„	6,528	6,826
Jamaica	„	4,363	4,363
Malta	„	60,403	69,746
Trincomalee	„	208	208
	£	123,377	134,254

Percy Smith,
Director of Engineering and Architectural Works.

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A STATEMENT showing the AMOUNTS brought to Account between the 1st April, 1884, and 31st March, 1885, for HER MAJESTY'S SHIPS and VESSELS SOLD.

Name of Ship.	Purchase Money received for Old and Unserviceable Ships, sold out of the Service. £	s.	d.	Remarks.
Owen Glendower	1,035	17	8	Proceeds of sale.
Psyche	52	10	0	,, ,,
Charybdis	*2,150	0	0	,, ,,
Rhin	1,250	0	0	,, ,,
Vigo	1,965	7	6	,, ,,
Spartan	5,217	4	11	,, ,,
Dromedary	1,750	0	0	,, ,,
Erebus	2,750	0	0	,, ,,
Gloucester	1,770	0	0	,, ,,
Widgeon	460	0	0	,, ,,
Mortar Boat, No. 8	230	0	0	,, ,,
Swallow	225	0	0	,, ,,
Glasgow	6,758	19	6	,, ,,
Vestal	3,734	16	3	,, ,,
Nymphe	3,745	4	0	,, ,,
Royal Sovereign	7,936	10	3	,, ,,
Royal Alfred	5,562	3	8	,, ,,
Research	3,326	16	6	,, ,,
Lapwing	2,191	6	6	,, ,,
Kangaroo (late Dart)	1,414	13	0	,, ,,
Fawn	2,106	11	0	,, ,,
Furious	1,309	11	6	,, ,,
Æolus	1,170	17	2	,, ,,
Worcester	1,602	5	3	,, ,,
Doris	5,296	10	0	,, ,,
Dauntless	2,167	8	3	,, ,,
Bullfinch	1,018	15	6	,, ,,
Bruiser	870	8	6	,, ,,
Lord Clyde	3,730	11	7	,, ,,
Enterprise	2,072	8	6	,, ,,
Echo and Dasher (Echo £1,000, and Dasher £900)	1,900	0	0	,, ,,
Steam Launch, No. 40	49	0	0	,, ,,
Total	76,820	17	0	

* This amount is exclusive of £350 allowed the purchaser for taking up decks, &c., to admit of the removal of boilers and engines.

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HEALTH OF THE NAVY.

REPORT FOR THE YEAR 1884. (Latest report presented to Parliament.)

SIR,—I have the honour to submit the Statistical Report of the Health of the Navy for 1884.

In comparison with the preceding year, and also with the average of the last ten years, an increase is shown by these Returns in the amount of sickness, invalidings, and deaths, in the Total Force employed, except in the ten years' average of deaths, which shows a trifling decrease. This increase, though distinctly marked, cannot be held to imply any retrogression in the general sanitary condition of the Force, but is due to exceptional causes in operation on some of the stations during the period. Thus, while the Home, Mediterranean, and East Indies Stations, and Irregular Force, show increases of sickness, which are capable of explanation from causes chiefly temporary, the other principal Stations exhibit less disease than in 1883.

On the Home Station the effects of the non-enforcement of the effectual clauses of the Contagious Diseases Acts continue to be manifested by an increase in the amount of the more serious form of venereal disease, the particulars of which will be found on pages 455–6. The present Returns show the highest yearly ratios of this form of disease which have ever been recorded in these Reports since their commencement in 1856, before there was any legislation on the subject. The most that can be said is that, so far as may be seen by examining the figures, the first sudden rise in the ratios that took place after the withdrawal of the compulsory examination clauses of the Acts does not seem to have been maintained.

The Returns from the Mediterranean Station show a large increase in all the forms of fever, resulting in much invaliding and several deaths. While a portion of this increased sickness is due to service in Egypt and the Soudan, where part of the Force was employed, ships stationed at Malta also suffered to a large extent, partly owing, no doubt, to a temporary local cause, viz., the construction of an improved system of sewerage for Valletta, which will, no doubt, result in good, but which has, during the progress of the works, apparently been the cause of much illness in the Island.

On the West Coast of Africa Station the visit of a ship to the River Niger has again been followed by unfortunate results. The number of men exposed to the climatic influences only consisted this

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year of one ship's company, numbering about seventy men, who had only been about four months from England; after a stay in the river of a little less than a month, during September and October, the whole crew, with only six exceptions, suffered from malarial fever of the type usual in those regions.

The East India Station is again unfortunate in the amount of climatic fever met with, although the stationary ship at Zanzibar, recently so prolific of this form of disease, has been removed. The ships from this station employed in the Red Sea suffered heavily in this respect, the Ports of Massowah and Suakim being the principal sources of disease. There was also a loss of life in this Force at the actions of Tamai and El Teb, amounting to thirteen, out of a total of twenty-five killed and wounded.

There has been less cholera encountered in the China Station in 1884 than in the preceding year; five cases, with four deaths, form the total; in all the cases the disease was contracted at Amoy or Shanghai.

The Irregular Force shows a large increase of climatic disease in the form of fevers, dysentery, and diarrhœa. The portion of this Force employed in the Red Sea, which includes the Royal Marine Battalion at Suakim, had to bear the brunt of that unhealthy climate, and suffered accordingly. The greater number of the injuries in action during the operations in the Soudan in 1884 were also sustained by this battalion.

I have the honour to be, Sir,
Your most obedient Servant,
WILLIAM H. LLOYD, M.D.,
Deputy Inspector General
of Hospitals and Fleets.

Admiralty, 44 Spring Gardens, S.W., 1884.

THE Total Force in the service afloat, corrected for time, in the year 1884, was 43,000 officers and men, of whom 22,960, or 53·39 per cent., were between the ages of fifteen and twenty-five; 14,470, or 33·65 per cent., were between the ages of twenty-five and thirty-five; 4585, or 10·66 per cent., were between the ages of thirty-five and forty-five; and 985, or 2·29 per cent., were above forty-five years of age.

The total number of cases of disease and injury entered on the

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sick-list was 49,814, which is in the ratio of 1158·46 per 1000, being an increase, compared with the preceding year, of 67·48 per 1000, and an increase of 5·46 per 1000, when compared with the average ratios for the last ten years. The average number of men sick daily was 2219·11, which is in the ratio of 51·6 per 1000, and is an increase, compared with the previous twelve months, amounting to 3·82 per 1000.

The number of days' sickness, on board ship and in hospital, in the Total Force, was 812,196, which gives an average loss of service from disease and injury of 18·88 days for each person, and is an increase, compared with the preceding year, to the extent of 1·44 days.

The total number of persons invalided was 2122, which is in the ratio of 49·34 per 1000, and the total number of deaths 387, being in the ratio of 9· per 1000. Compared with the preceding year there was an increase in the ratio of invaliding to the extent of 10·59 per 1000, and an increase in the death-rate of 3·12 per 1000.

The average number of entries on the sick-list for disease and injury per man on the Home Station was ·9; on the Mediterranean Station, 1·43; on the North American and West Indian Station, 1·99; on the South East Coast of America Station, 1·07; on the Pacific Station, ·99; on the West Coast of Africa and Cape of Good Hope Station, 1·11; on the East Indies Station, 1·74; on the China Station, 1·54; on the Australian Station, 1·; and in the Irregular Force, 1·42. The average number of cases per man in the Total Force was 1·15, being ·06 more than in 1883.

The lowest sick-rate was on the South East Coast of America Station, and the highest in the Irregular Force. The ratio per 1000 men of sick daily on the Home Station was 51·85; Mediterranean, 52·39; North America and West Indies, 35·06; South East Coast of America, 31·14; Pacific, 39·95; West Coast of Africa and Cape of Good Hope, 38·92; East Indies, 53·11; China, 50·05; Australia, 44·7; and in the Irregular Force, 66·19. The average ratio of sickness for the Total Force was 51·6, which is an increase of 3·82 per 1000 when compared with the preceding year.

The total number of persons invalided was 2122, of whom 1975 were invalided for disease, and 147 for injury. The ratio of invaliding for disease alone was 45·93 per 1000, and for injury 3·41 per 1000, the total invaliding rate for disease and injury being 49·34 per 1000, which was an increase of 10·59 per 1000 when compared with 1883. The invaliding ratio on the Home Station was 40·54 per 1000; Mediterranean, 81·49; North America and West Indies, 22·31; South East Coast of America, 24·39; Pacific, 26·; West Coast

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of Africa and Cape of Good Hope, 36·42; East Indies, 75·12; China, 20·12; Australia, 23·14; and Irregular Force, 77·75. Compared with the preceding year, there was an increase in the invaliding rate on the Home, Mediterranean, South East Coast of America, Pacific, East Indies, and Irregular Force, and a reduction on all the other Stations.

The total number of deaths was 387; of this number 251 were due to disease, and 136 to injury; the death-rate from disease alone was 5·83 per 1000, and from violence 3·16. The total death-rate was 9· per 1000, which is an increase of 3·12 per 1000, when compared with the preceding year.

The ratio per 1000 of deaths on the Home Station, from disease, was 4·3, from violence, 3·93: Mediterranean, from disease, 5·75, from violence, 1·24; North America and West Indies, from disease, 2·47, from violence, 1·23; South East Coast of America, from disease, 4·87, from violence, 0; Pacific, from disease, 4·, from violence, ·66; West Coast of Africa and Cape of Good Hope, from disease, 5·71, from violence, 1·42; East Indies, from disease, 15·02, from violence, 8·29; China, from disease, 5·4, from violence, 2·4; Australia, from disease, 3·3, from violence, 3·3; Irregular Force, from disease, 10·51, from violence, 3·62.

Compared with last year, there was an increase in the death-rate on the Home, Mediterranean, West Coast of Africa and Cape of Good Hope, East Indies, and Australian Stations, and in the Irregular Force, and a reduction on all other Stations.

Under the head of General Diseases, Febrile Group, there were entered on the sick-list in the Total Force during the year 4492 cases; 357 of these resulted in invaliding, and there were ninety-three deaths. The ratio per 1000 of Force was 104·46, as compared with 75·01 for 1883, and 73·25 the average ratio for the last ten years.

Small Pox.—Six cases are shown, two on the Home, and four on the China Stations.

Measles.—There were forty-three cases under treatment, of which thirty-four were on the Home, two on the Mediterranean, one on the China Stations, and six in the Irregular Force.

Scarlet Fever.—Twenty-five cases are returned, viz., twenty on the Home Station, one each on the Mediterranean, North American and West Indian Stations, and Irregular Force, and two on the Pacific Station.

Typhus Fever.—Only one case is recorded; it was on the Home Station.

Enteric Fever.—There were 113 cases of enteric fever treated during the year; of these, twenty-nine were on the Home Station,

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twenty-seven on the Mediterranean, two on the North American and West Indian, two on the South East Coast of America, four on the East Indies, ten on the China, and three on the Australian Stations, and thirty-six in the Irregular Force.

Simple Continued Fever.—Of this disease 2218 cases are recorded; of these 502 were on the Mediterranean, 512 on the East Indian, and 411 on the China Stations, and 429 in the Irregular Force.

Yellow Fever.—Only one case returned, on the Pacific Station.

Ague.—There are 341 cases recorded; the West Coast of Africa and Cape of Good Hope Station returns the largest number, 139.

Remittent Fever.—This form of fever furnished 1615 cases to the total. The largest number was on the Mediterranean Station, where there were 622 recorded; the East India Station returned 365 cases, and the Irregular Force, 340.

Cholera.—Five cases of cholera, with four deaths, were encountered on the China Station.

The number of cases returned under the head of General Diseases, Constitutional Group, was 6491, the number of persons invalided 439, and the deaths thirty-nine.

Rheumatism.—The number of cases of rheumatism under treatment during the year was 2425, being in the ratio of 56·39 per 1000, and showing an increase of 3·55 per 1000, when compared with 1883, and an increase of 1·51 per 1000 in comparison with the average of the last ten years. The number invalided was 161, being in the ratio of 3·74 per 1000, and the deaths were six, equal to ·13 per 1000. Both these ratios show a slight increase when compared with the preceding year. The average duration of each case was 18·17 days, and the number of men daily ineffective 120·4. The latter number shows an increase of 5·39, compared with 1883.

Syphilis.—Of the primary form of this disease 2809 cases were under treatment, and 955 cases of secondary syphilis are returned. The former is in the ratio of 65·32 per 1000, and shows an increase of 4·79 per 1000, and the latter equals 22·2 per 1000, and also shows an increase equal to 2·76 per 1000, when compared with 1883. The returns from the Home Station show an increase of primary syphilis amounting to 11·8 per 1000; on the Mediterranean Station there was a decrease of 2·58 per 1000; on the North America and West Indian, a decrease of 25·4 per 1000; on the South East Coast of America, an increase of 1·98 per 1000; on the Pacific, a decrease of 8 per 1000; on the West Coast of Africa and Cape of Good Hope, a decrease of ·69 per 1000; on the East Indies, a decrease of 3·08 per 1000; on the China Station, a decrease of 10·87 per 1000; on the

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Australian Station, a decrease of 14·2 per 1000; and in the Irregular Force, an increase of 35,75 per 1000. The invaliding ratios for the Total Force were for the primary disease ·37 per 1000, and for the secondary form 2·41 per 1000.

Tubercular Diseases. — There were 187 cases of these diseases returned as under treatment, of which 176 were of phthisis, and eleven of scrofula; 150 persons were invalided for these diseases, and thirty-one deaths from phthisis are recorded. The ratio of cases for the Total Force was 4·34 per 1000, of invaliding 3·48 per 1000, and of deaths ·72 per 1000. These ratios are all somewhat less than the averages for the last ten years. The ratios per 1000 of cases of these diseases were highest on the Home Station, and of invaliding for them on the China Station. The number of cases on the Home Station was ninety-seven, and the ratio per 1000, 5·22.

Diseases of the Nervous System, &c.—There were 1517 cases returned during the year, with 272 invalidings, and thirty-one deaths. The East Indies Station and the Irregular Force show the highest ratios, the South East Coast of America and China Stations coming next.

Diseases of the Circulatory System.—In this class 323 cases appear; of these, 193 were invalided, and twenty-one ended fatally. The ratio of cases is 7·51 per 1000, somewhat less than the average for the last ten years, which is 8·14. The Australian, China, and Home Stations return the highest ratios.

Diseases of the Respiratory System.—The number of cases included under this head was 3514, the invalidings numbered fifty-seven, and the deaths thirty-four. The ratio of cases is 81·72 per 1000, and shows a decrease of 3·21 per 1000, the invaliding ratio of 1·32 per 1000 shows a decrease of ·13 per 1000, and the death-rate a decrease of ·04 per 100, when compared with 1883. The ratios were highest on the Home, China, and Australian Stations.

Diseases of the Digestive System.—The cases under this head numbered 6690, the ratio, 155·58 per 1000, showing an increase of 20·2 per 1000, when compared with 1883. There were 239 invalidings, showing an increase in the ratio of 1·59 per 1000, and the deaths, which numbered twenty-four, show a ratio higher by ·23 per 1000 than that of 1883. This class of diseases prevailed most on the East India and China Stations, and in the Irregular Force.

Diseases of the Urinary and Generative Systems.—There were 4016 men of the Total Force under treatment for these diseases during the year, and the ratio was 93·29 per 1000, a decrease of ·65 per 1000 compared with the preceding year; the invaliding ratio is slightly lower, and the death-rate slightly higher, than that of 1883. There

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were 3089 cases of gonorrhœa tabulated, showing a decrease in the ratio of ·25 per 1000 in comparison with 1883. The China Station had the highest ratio, viz., 124·92 per 1000, and the Home Station the next, 107·86 per 1000; the Irregular Force shows the next largest ratio.

Diseases of the Cellular Tissue and Cutaneous System.—Under this head 10,598 cases are recorded; the ratio per 1000 was 246·46, and was less by ·57 per 1000 than that of 1883. The forty-one invalidings show a ratio of ·95 per 1000, ·24 per 1000 under last year's ratio. There was no death. The largest ratio was on the East Indies Station, where it reached 395·33 per 1000.

Debility, Observation, &c.—Eleven hundred and twenty-six cases are here recorded, showing a ratio of 26·18 per 1,000. There were 252 invalidings, but no death.

Poisoning.—There were seventy-six cases in which illness was ascribed to the action of various poisons; of these, sixty-two were due to the effects of alcohol. There was no fatal case of poisoning during the year.

Wounds and Injuries.—There were 10,123 injuries returned from the Total Force during the year; the ratio per 1000 is 235·41, being 1·37 per 1000 higher than in 1883, and 17·81 per 1000 less than the average for the last ten years. This number includes 9363 wounds and fractures, &c., 594 burns and scalds, eighty-five cases of submersion and drowning, two of asphyxia, seven cases of suicide, and seventy-two injuries in action. There were 147 invalidings, and 136 deaths. Of these latter, thirty-one were by wounds, fractures, &c., one by burns, seventy-six from accidental drownings, seven by suicide, and twenty-one by wounds in action. Of the suicides, one was by shooting, four by drowning, one by cut throat, and one by the man throwing himself from a height.

Wounds in Action.—Seventy-two cases are returned; seven persons were invalided, and there were twenty-one deaths. Two of the cases appear in the returns of the Mediterranean, and twenty-five in those of the East Indies Station, while forty-five were in the Irregular Force; all the cases, however, occurred in the Soudan, the force employed in the operations there having been composed of men from the stations mentioned.

The total number of deaths from injury was 136, which gives the ratio of 3·16 per 1000, and shows an increase of 1·34 per 1000 when compared with the preceding year.

The average number of men sick daily from General Diseases, Febrile Group, was 220·9, and from the Constitutional Group, 508·25;

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from diseases of the nervous system, 36·59; of the eye, 23·18; of the ear, 13·49; of the nose, ·55; of the circulatory system, 26·71; of the absorbent system, 54·41; of the respiratory system, 102·52; of the digestive system, 142·71; from gonorrhœa, 237·54; from its sequelæ, 20·89; from other diseases of the urinary and generative systems, 34·16; of the organs of locomotion, 19·46; of the cellular tissue and cutaneous system, 366·24; from debility, &c., 67·83; from poisons, 2·21; from wounds and injuries, 340; and from wounds in action, 1·39.

TABLE showing the DEATH-RATE from ALL CAUSES, and the DEATH-RATE from DISEASE ALONE, in the SERVICE AFLOAT, between the Years 1856 and 1884, inclusive.

Year.	Death-rate from all causes.	Death-rate from Disease alone.	Year.	Death-rate from all causes.	Death-rate from Disease alone.
1856	15·5	12·1	1871	8·5	6·3
1857	19·4	14·7	1872	8·2	5·6
1858	25·8	22·	1873	8·3	6·
1859	16·7	11·8	1874	9·4	6·7
1860	14·7	11·1	1875	8·8	6·9
1861	15·	11·5	1876	9·24	5·99
1862	15·3	9 6	1877	7·05	4·91
1863	11·3	7·6	1878	14·41	5·32
1864	14·	9·	1879	8·58	6·23
1865	11·3	8·1	1880	12·57	4·62
1866	10·2	7·9	1881	10·94	5·27
1867	11·5	8·4	1882	9·49	6·87
1868	8·9	6·5	1883	5·88	4·05
1869	9·9	7·3	1884	9·	5·83
1870	19·6	6·7			

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French Navy Estimates.

Head of Service.		Proposed 1886.	Voted 1885.
		£	£
Central Administration		54,144	54,192
Hydrographic Office		19,720	19,720
Officers and Seamen afloat and ashore		1,791,088	1,803,256
Barracks for Seamen		5,968	5,968
Naval School		10,172	10,172
Troops		552,136	562,668
Maritime Gendarmerie		37,244	38,332
Barracks for Troops		36,952	36,952
Dockyard and other Civilian Officers		188,884	189,292
Leading Men, Police, Firemen		127,592	126,076
Victuals for Seamen, &c.		799,348	814,064
Hospitals		121,232	112,532
Naval Construction.	Wages. Manufacture of Stores	111,200	111,200
	„ New Construction	312,000	312,200
	„ Repairs of Ships	156,000	156,000
	„ General Service	245,988	246,240
	Purchase of Stores and Ships built by Contract	1,921,440	1,921,440
Naval Ordnance.	Wages and Stores	773,228	773,276
Hydraulic Works and Buildings		372,920	372,948
Martial Law		8,940	9,000
Printing and purchase of Books		22,984	22,984
Travelling Expenses		154,352	144,000
Miscellaneous Expenses		27,016	27,016
Secret Service		2,600	2,600
Maritime Inscription, fisheries, &c.		3,488	3,488
Grant to the "Caisse des Invalides"		186,620	
	Total	8,043,296	7,575,616

N.B.—In addition to the above Estimates a Supplementary Estimate of £195,200, for the service of the year 1886, was presented by Admiral Aube for naval expenses incurred in consequence of the operations in Madagascar and for recall of troops.

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PROVISION is made in FRENCH ESTIMATES, 1886, for CONSTRUCTION of following VESSELS.

Name of Ship.	Description.	Tonnage.	Speed.	Where Building.
ARMOURED SHIPS:			Knots.	
Neptune	Armourclad	10,581	15	Brest.
Formidable	,, ,,	11,380	15	Lorient.
Hoche	,, ,,	10,581	15	,,
Magenta	,, ,,	10,581	15	Toulon.
Marceau	,, ,,	10,581	15	Mediterranée (Contract.)
Requin	,, ,,	7,200	14	St. Gironde.
*Brennus	,, ,,	10,650	15	Lorient.
*Charles Martel	,, ,,	10,650	15	Toulon.
Cocyte (1st class)	Armoured Gunboat	1,639	13	Cherbourg.
Phlégéton ,,	,, ,,	1,639	13	,,
Styx ,,	,, ,,	1,639	13	,,
Grenade (2nd class)	,, ,,	1,045	13	Lorient.
UNARMOURED SHIPS:				
Sfax	Deck-protected Cruiser	4,488	16	Brest.
Tage	,, ,,	7,045	19	Cherbourg.
Cecille	,, ,,	5,766	19	Rochefort.
N.	Cruiser	2,600	18	Contract.
Epervier	Torpedo Cruiser	1,280	17	Rochefort.
Faucon	,, ,,	1,280	17	Toulon.
Vautour	,, ,,	1,280	17	,,
Fulton	Aviso (1st class)	810	13	Lorient.
Papin	,, ,,	825	13	Toulon.
Inconstant	,, ,,	810	13	Rochefort.
Jouffroy	Sloop (2nd class)	310		Lorient.
N.	,, ,,			Contract.
N.	,, ,,			,,
Marche	Aviso Transport	1,580	10·5	Cherbourg.
Rance	,, ,,	1,600	10·5	Lorient.
Durance	,, ,,	1,600	10·5	Rochefort.
Aube	,, ,,	1,580	10·5	Normand.
Eure	,, ,,	1,580	10·5	,,
Couleuvrine	Torpedo Gunboat	320	18·	Mediterranée (Contract.)
Dague	,, ,,	320	18·	,, ,,
Dragonne	,, ,,	320	18·	,, ,,
Flèche	,, ,,	320	18·	,, ,,
Lance	,, ,,	320	18·	,, ,,
Sainte Barbe	,, ,,	320	18·	Claparède. ,,
Salve	,, ,,	320	18·	,,
N.	Gunboat			Rochefort.
N.	,,			Contract.
N.	,,			,,
Balny	Seagoing Torpedo Boat			Normand (Contract.)
Deroulède	,, ,, ,,			,, ,,
Doudart de Lagrée	,, ,, ,,			,, ,,
Bouet-Willaumez	,, ,, ,,			Claparède. ,,
Capitaine Cuny	,, ,, ,,			Soc de la Loire. ,,
Capitaine Mehl	,, ,, ,,			,, ,, ,,
Edouard Fontaine	,, ,, ,,			Claparède.
N.	,, ,, ,,			Contract.
N.	,, ,, ,,			,,
N.	,, ,, ,,			,,
N.	,, ,,			,,
Pacifique	Transport Boat	3,991		Brest.
N.	,, ,,			Contract.
Andromède	Sailing Frigate			Lorient.
Melpomène	,, ,,			Rochefort.
Bayonnais	Sailing Corvette			Brest.
Sylph	,, ,,			,,

* All work in these vessels has been suspended.

(The above list is taken from the French Projet for 1886. For complete list of Armourclads, Cruisers, and Torpedo Boats, see next page.)

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List of French Armoured Vessels, Cruisers, Torpedo Vessels and Torpedo Boats, completing or Building.

(From Return No. 153, presented to House of Commons 17 May, 1886.)

N.B.—It will be seen from list on preceding page that no money has been taken in 1886 for work on several of these Vessels.

Name.	Description.	Displacement Tons.	Speed.
ARMOURED SHIPS:			Knots.
Amiral Baudin	Armourclad	11,380	15
Formidable	„	11,380	15
Neptune	„	10,581	15
Hoche	„	10,581	15
Magenta	„	10,581	15
Marceau	„	10,581	15
*Brennus	„	10,650	15
*Charles Martel	„	10,650	15
Courbet	„	9,700	15
Indomptable	„	7,200	14·5
Terrible	„	7,200	14·5
Caiman	„	7,200	14·5
Requin	„	7,200	14
Duguesclin	Armoured Cruiser	5,900	14
Achéron	Armoured Gunboat (1st Class)	1,639	13
Cocyte	„ „ „	1,639	13
Phlégéton	„ „ „	1,639	13
Styx	„ „ „	1,639	13
Flamme	„ „ „	1,045	13
Fusée	„ „ (2nd Class)	1,045	13
Mitraille	„ „ „	1,045	13
Grenade	„ „ „	1,045	13
UNARMOURED SHIPS:			
Sfax	Deck-protected Cruiser	4,488	16
Tage	„ „	7,045	19
Cecille	„ „	5,766	19
Surcouf	Cruiser	1,850	19·5
Forbin	„	1,850	19·5
Epervier	Torpedo Cruiser	1,280	17
Faucon	„ „	1,280	17
Vautour	„ „	1,280	17
Couleuvrine	Torpedo Aviso	320	18
Dague	„ „	320	18
Dragonne	„ „	320	18
Flèche	„ „	320	18
Lance	„ „	320	18
Sainte-Barbe	„ „	320	18
Salve	„ „	320	18

9 Seagoing Torpedo Boats, 133 feet in length.

51 First-class Torpedo Boats for Coast Defence, from 108 to 114 feet.

* Work on these Vessels has been suspended.

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ABSTRACT of NUMBER of ARMOURED VESSELS, CRUISERS, TORPEDO VESSELS, and TORPEDO BOATS • COMPLETING or BUILDING IN FRANCE.

Armoured Vessels*	12
Armoured Gunboats	8
Cruisers	4
Torpedo Vessels, &c.	10
Torpedo Boats	60
Total	94

ESTIMATED EXPENDITURE on CONSTRUCTION of NEW VESSELS, HULLS and MACHINERY—DOCKYARD and CONTRACT.

	1886.	1885.
	£	£
Armoured Vessels	765,980	793,720
Armoured Gunboats	104,944	51,360
Unarmoured Vessels	484,760	665,624
	1,355,684	1,510,704

COMPARATIVE STATEMENT showing EXPENDITURE on CONSTRUCTION of NEW VESSELS, HULLS and MACHINERY, in ENGLAND and FRANCE, from 1864 to 1886–87.

Year.	England.	France.
	£	£
1863–64	1,282,710	
1864–65	1,674,574	920,196
1865–66	1,116,198	873,300
1866–67	1,014,406	931,348
1867–68	1,800,749	875,468
1868–69	1,694,362	797,104
1869–70	1,387,047	668,780
1870–71	1,330,814	655,016
1871–72	1,184,172	411,948
1872–73	809,087	429,832
1873–74	1,290,028	614,460
1874–75	1,528,161	789,684
1875–76	1,613,218	921,380
1876–77	2,121,960	1,054,560
1877–78	2,922,442	1,301,988
1878–79	1,508,049	1,501,884
1879–80	1,388,607	1,504,656
1880–81	1,426,349	1,375,296
1881–82	1,682,500	1,345,084
1882–83	1,767,014	1,400,152
1883–84	1,930,090	1,559,644
1884–85	2,242,070	1,536,508
1885–86	3,544,524	1,510,704
1886–87	3,664,027	1,355,684

* Excluding Brennus and Charles Martel.

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THE ARMOURED AND UNARMOURED FIGHTING SHIPS OF FRANCE LAID DOWN TO BUILD SINCE 1880.

ARMOURED SHIPS.			UNARMOURED SHIPS.		
Ship's Name.	Type.	Displacement in Tons.	Ship's Name.	Type.	Displacement in Tons.
		1880.			
			Dubourdieu	Cruiser	3,300
			Scorff	Despatch transport	1,570
			Capricorne	Gunboat	475
			Sagittaire	„	445
			Albatros	Paddle despatch boat	575
Nil.	Nil.	Nil.	Pluvier	Paddle despatch boat	540
			Oyapock	Paddle despatch boat	205
			Ecureuil	Paddle despatch boat	325
			Chimère	Screw despatch boat	260
		1881.			
Hoche	1st Class fighting ship	10,470	Milan	Cruiser	1,520
			Volage	Screw despatch boat	500
			Comète	Gunboat	475
			Météore	„	475
			Alouette	Paddle despatch boat	450
			Eclair	Paddle gunboat	195
			Trombe	„ „	195
		1882.			
Marceau	1st Class fighting ship		Sfax	Deck protected Cruiser	4,430
Neptune	1st Class fighting ship	10,400	Inconstant	Despatch vessel	810
			Fulton	„ „	810
		10,400	Papin	„ „	810
			Durance	Despatch transport	1,570
			Meurthe	Despatch transport	1,570
			Lion	Gunboat	475
			Scorpion	„	475
			Etoile	„	440
			Gabes	„	475
			Vigilant	Paddle despatch boat	980
			Brandon	Paddle despatch boat	560

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Armoured and Unarmoured Fighting Ships of France laid down since 1880—*continued.*

Armoured Ships.			Unarmoured Ships.		
Ship's Name.	Type.	Displacement in Tons.	Ship's Name.	Type.	Displacement in Tons.
			1882—(*continued*).		
			Ardent	Paddle despatch boat	560
			Mésange	Paddle despatch boat	565
			Ibis	Screw despatch boat	250
			Golland	Paddle despatch boat	595
			Héron	Paddle despatch boat	595
			1883		
Magenta	1st Class fighting ship	10,400	Condor	Torpedo vessel	1,270
Acheron	1st Class gunboat	1,610	Epervier	,, ,,	1,270
Cocyte	,, ,,	1,610	Bombe	Torpedo despatch boat	316
Flamme	2nd Class gunboat	1,030	Dague	Torpedo despatch boat	316
Fusée	,, ,,	1,030	Flèche	Torpedo despatch boat	316
Grenade	,, ,,	1,030	Sainte-Barbe	Torpedo despatch boat	316
			Couleuvrine	Torpedo despatch boat	316
			Dragonne	Torpedo despatch boat	316
			Lance	Torpedo despatch boat	316
			Salve	Torpedo despatch boat	316
			Jouffroy	Paddle despatch boat	305
			Alcyon	Paddle despatch boat	305
			Arquebuse, Alerte, Avalanche, Bourrasque, Mutine, Rafale, Redoute, Tirailleuse	Screw gunboats	110
			Henri-Rivière, Garnier, Carreau, Berthe-de-Villers, Pionnier, Moulin, Jacquin	Wheel gunboats for river service	125

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THE ARMOURED AND UNARMOURED FIGHTING SHIPS, &c.—*continued.*

ARMOURED SHIPS.			UNARMOURED SHIPS.		
Ship's Name.	Type.	Displacement in Tons.	Ship's Name.	Type.	Displacement in Tons.
			1884.		
Phlégéton . .	1st class gunboat	1,610	Vautour . .	Torpedo vessel	1,270
Styx . .	,, ,,	1,610	Faucon . .	,, ,,	1,270
Mitraille . .	2nd class gunboat	1,030	Aube . .	Despatch transport . .	1,560
			Eure . .	Despatch transport . .	1,560
			Rance . .	Despatch transport . .	1,560
			Salamandre .	Paddle despatch boat . .	295
			Pingouin . .	Paddle despatch boat . .	295
			Baïonnette .	Screw gunboats "Arquebuse" type . .	110
			Casse-Tete .		
			Carronade .		
			Cimeterre .		
			Estoc . .		
			Bouclier . .		
			1885.		
	Nil		Amiral Cécille .	Deck Protected Criuser .	5,680
			Tage . .	Deck Protected Cruiser .	7,045
			Sirius . .	Screw gunboat	465

(For corresponding Table of Fighting Ships of England laid down since 1880, see page 412.)

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Extracts translated from Report of the Commission appointed to consider the French Navy Estimates for 1886.

The Commission was composed of MM. Rouvier, President; Labuze, Baihault, Vice-Presidents; Deluns-Montaud, Gerville, Réache, Escande, Secretaries; and 27 members.

Personnel.

The number of officers available for sea-service is altogether insufficient to meet any emergency. This was painfully apparent during the late Tonquin expedition.

At the commencement of 1885 the Admiralty were obliged to reduce very seriously the complements of transports and home stationary ships, in order to provide officers for active service.

The total effective list of officers and men amounts in 1886 to—

	On Shore.	Afloat.	Reserve.	Total.
Vice-Admirals	17	1	..	18
Rear-Admirals	24	6	..	30
Captains	68	30	3	101
Commanders	119	67	14	200
Lieutenants	363	334	27	724
Sub-Lieutenants	170	242	8	420
Midshipmen, Naval Cadets, &c.	..	251	..	251
Professors	..	15	..	15
Total	761	946	52	1,759
Engineers	68	47	19	134
Constructive Staff	124	3	..	127
Hydrographical Staff	16	2	..	18
Commissariat Officers	330	99	14	443
Medical Officers	389	164	14	567
Crews	9,667	25,015	2,574	37,256
Pensioners	2,063	..	..	2,063
Total, Officers and Crews	13,418	26,276	2,673	42,367

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Extracts from Report of French Commission—continued.

The number of officers in English Navy is much larger, and their organization superior in two respects—

1. Average age of higher rank is lower;
2. Age for retirement is younger.

The chief difficulty consists in obtaining a proper staff of engineer officers. Under the present system, the Navy is merely a school for recruiting the Merchant Service. The remedy for this evil can only be found by improving the relative rank of the engineer officer, as in England, and by increasing the number of the higher appointments.

With regard to the remainder of the *personnel*, it can only be remarked that the present unfortunate state of commercial stagnation has driven many to seek for service in the Navy who could not find employment elsewhere.

This has temporarily met the difficulty so far as numbers are concerned, and though there is nothing to complain of in the quality of the engineers and warrant officers, yet many have had to be promoted to the rank of quartermasters and petty officers without sufficient experience in the lower ranks.

Materiel.

The French Navy will bear favourable comparison with all other Powers, except England.

The English Navy is not only greatly superior in vessels of war, but also in the ships of the mercantile marine, which can be rapidly converted into armed cruisers.

The following Table shows the relative strength of the principal European fleets in completed ships up to the end of 1884:—

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Extracts from Report of French Commission—continued.

NUMBER OF FIGHTING SHIPS OF

FRANCE.

Category.	Kind.	Completed. Types modern.	Completed. Types ancient.*	Fitting out.	Building.	To be laid down in 1885.	Total.	Total of category.
Armoured vessels	squadron	3	7+ 7	5	8	..	30	68 of which 24 are unseaworthy.
	cruisers	2	3+ 6	2	..	..	13	
	coast protection	4	0+ 6	2	..	..	12	
	gunboats 1st class	..	..	1	3	..	4	
	gunboats 2nd class	..	..	..	4	..	4	
	floating batteries	..	0+ 5	..	..	..	5	
Cruisers	spar deck	4	0+ 5	3	..	3	15	64 of which 15 are unseaworthy.
	1st class	9	..	..	..	3	12	
	2nd class	3	9+ 3	..	..	..	15	
	3rd class	..	11+ 7	..	..	..	18	
	torpedo	..	..	..	4	..	4	
Despatch vessels, &c.	1st class	8	2+ 7	..	3	..	20	84 of which 18 are unseaworthy.
	2nd class	17	1+ 8	2	2	..	30	
	3rd class	6	0+ 2	..	..	1	9	
	transports	10	0+ 1	..	6	..	17	
	torpedo	..	..	1	7	..	8	
Gunboats and Sloops	gunboats	11	0+10	1	2	..	24	77 of which 31 are unseaworthy.
	gunboat sloops	25	0+21	..	..	7	53	
Torpedo boats	seagoing	..	..	..	9	..	9	79
	1st class	12	..	..	6	..	18	
	2nd class	43	..	..	..	..	43	
	vedettes	9	..	..	..	..	9	

ENGLAND.

Armoured vessels	squadron	17	12	1	6	4	40	66
	cruisers	9	1	1	..	..	11	
	coast protection	..	..	..	..	..	..	
	gunboats 1st class	9	3	..	..	..	12	
	gunboats 2nd class	..	3	..	..	..	3	
	floating batteries	..	..	..	..	..	..	
Cruisers	spar deck	6	3	..	6	..	15	93
	1st class	17	2	2	3	..	24	
	2nd class	11	12	2	1	..	26	
	3rd class	..	2	2	..	..	4	
	torpedo	8	..	..	9	7	24	
Despatch vessels, &c.	1st class	19	12	..	3	..	34	96
	2nd class	11	39	..	..	..	50	
	3rd class	..	..	..	..	..	..	
	transports	7	4	..	..	..	11	
	torpedo	..	..	..	1	..	1	
Gunboats and Sloops	gunboats	33	23	..	..	5	61	96
	gunboat sloops	6	27	..	2	..	35	
Torpedo boats	seagoing	1	..	..	1	..	2	86
	1st class	20	..	..	4	10	34	
	2nd class	48	..	..	..	..	48	
	vedettes	2	..	..	..	..	2	

* In the column of "Ancient Types," the first figure indicates serviceable ships—the second figure those past service.

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Extracts from Report of French Commission—continued.

THE PRINCIPAL EUROPEAN FLEETS.

ITALY.*

Category.	Kind.	Completed. Types modern.	Completed. Types ancient.	Fitting out.	Building.	To be laid down in 1885.	Total.	Total of category.
Armoured vessels.	squadron	2	7	2	5	..	16	20
	cruisers	..	2	..	..	..	2	
	coast protection	..	1	..	..	..	1	
	gunboats 1st class	..	1	..	..	..	1	
	gunboats 2nd class	..	..	..	..	..	..	
	floating batteries	..	..	..	..	..	..	
Cruisers	spar deck	2	2	1	..	..	5	17
	1st class	1	1	..	3	..	5	
	2nd class	1	..	..	..	..	1	
	3rd class	4	2	..	..	..	6	
	torpedo	..	..	..	..	..	..	
Despatch vessels, &c.	1st class	..	..	..	..	..	..	8
	2nd class	3	1	1	1	..	6	
	3rd class	..	..	..	..	..	..	
	transports	..	..	..	..	..	..	
	torpedo	1	..	..	1	..	2	
Gunboats and Sloops	gunboats	..	..	..	..	..	..	6
	sloop gunboats	..	6	..	..	..	6	
Torpedo boats.	seagoing	..	..	..	2	18	20	69
	1st class	24	..	1	3	..	28	
	2nd class	21	..	..	..	..	21	
	vedettes	..	..	..	..	..	..	

GERMANY.†

Armoured vessels.	squadron	8	3	1	2	..	14	38
	cruisers	..	1	..	..	..	1	
	coast protection	..	1	..	..	5	6	
	gunboats 1st class	11	..	..	..	..	11	
	gunboats 2nd class	2	..	..	2	..	4	
	floating batteries	..	..	..	..	2	2	
Cruisers	spar deck	8	2	..	1	..	11	30
	1st class	..	..	1	4	..	5	
	2nd class	6	2	..	..	..	8	
	3rd class	..	2	..	..	..	2	
	torpedo	4	..	..	..	..	4	
Despatch vessels, &c.	1st class	4	..	..	2	..	6	19
	2nd class	4	1	..	..	..	5	
	3rd class	1	7	..	..	..	8	
	transports	..	..	..	..	..	..	
	torpedo	..	..	..	..	..	..	
Gunboats and Sloops	gunboats	1	..	..	..	..	1	1
	sloop gunboats	..	..	..	..	..	..	
Torpedo boats.	seagoing	1	..	..	..	..	1	79
	1st class	8	..	..	23	43	74	
	2 class	3	..	..	1	..	4	
	vedettes	..	.. ..	..	..	..	..	

* According to the programme of 1877, Italy should have in 1877:—16 vessels of 1st class; 10 of the 2nd class; and 20 of the 3rd class. Total 46.

† The German programme of 1873 included:—3 armoured frigates; 6 armoured corvettes; 7 monitors; 2 floating batteries; 20 corvettes; 6 avisos; 18 gunboats; 2 artillery ships; 3 sailing ships; 10 large and 8 small torpedo boats.

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Extracts from Report of French Commission—continued.

TABLE SHOWING NUMBER OF THE FIGHTING SHIPS OF THE PRINCIPAL EUROPEAN POWERS—*continued.*

RUSSIA.*

Category.	Class.	Completed. Modern type.	Completed. Ancient type.	Fitting out.	Building.	To be laid down in 1885.	Total of class.	Total of category.
Armoured vessels	squadron	1	7	..	5	..	13	39
	cruisers	4	2	1	4	..	11	
	coast protection	2	3	..	..	..	5	
	gunboats 1st class	..	..	..	..	..	..	
	gunboats 2nd class	..	..	..	..	..	..	
	floating batteries	..	10	..	..	..	10	
Cruisers	spar deck	..	1	..	..	..	1	32
	1st class	9	1	..	..	..	10	
	2nd class	..	8	..	..	..	8	
	3rd class	10	1	..	..	..	11	
	torpedo	1	..	..	1	..	2	
Despatch vessels, &c.	1st class	2	8	..	..	..	10	53
	2nd class	3	26	..	..	..	29	
	3rd class	..	14	..	..	..	14	
	transports	..	..	..	..	..	..	
	torpedo	..	..	..	..	..	..	
Gunboats and Sloops	gunboats	9	29	..	2	..	40	40
	sloop gunboats	..	..	..	..	..	..	
Torpedo boats	seagoing	2	..	..	..	..	2	120
	1st class	4	..	..	3	..†	7	
	2nd class	110	..	..	1	..	111	
	vedettes	..	..	..	..	..	..	

* A scheme for the reorganization of the fleet was suspended in May, 1882. It ought to be carried out in 20 years.
† No information.

No account must be taken of the ships shown as "about to be commenced," as the Table avowedly leaves out of calculation the measures recently taken by England, Germany, Russia, and Italy, to increase their naval power.

The number of French ships in commission, undergoing trials and in reserve, provided for in 1886, is 229, with complements of 28,951, as compared with 235 in 1885, with complements of 29,656, a reduction of 6 ships and 705 men.

Of the above number, the Naval service, properly so called, only employs 95 vessels—including 57 used for school ships and miscellaneous services—which thus reduces to 38 the number of ships composing the squadron and normal divisions, with complements of 10,310 officers and seamen. The local service for the Colonies

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Extracts from Report of French Commission—continued.

employs 41 vessels, with crews of 2875. It is impossible to say whether this force would be sufficient for a state of war, as everything would depend on the enemy we had to meet.

All we can say is, that in the event of a war against an active enemy, we should be forced, even if opposed to a second-rate Naval power, to employ in the defence of our coast the greater part of the fleet, whose business it should be to take the offensive. Thus, our first care should be to multiply the number of our torpedo boats; the least costly mode of defence for our coasts.

We possess, at the present time, exclusive of ships under construction, ten sea-going ironclads, of which four are in commission—the Amiral Duperré, the Devastation, the Colbert, and the Suffren—one ready for commission, and five under repair.

Seven of these ironclads are of a type already out of date: Colbert, Friedland, Marengo, Océan, Richelieu, Suffren, Trident. With the exception of the Friedland, they are all wood-built, and without water-tight compartments.

Our ironclad fleet is completed by five armoured cruisers, and four vessels for coast defence. The five armoured cruisers do not possess a speed worthy of a fighting vessel.

The vessels for coast defence are less open to criticism.

The armoured fleet under construction comprises thirteen ironclads, having an advantage in point of speed over those already completed; two armoured cruisers, two ships for coast defence, and eight armoured gunboats for coast defence, a service in which the latter class will be much less efficacious than torpedo boats.

If the torpedo had not in a great degree equalized the armourclad resources of maritime nations, we should regard our ironclads as absolutely insufficient.

We have only four cruisers—Duquesne, Tourville, Milan, and Hirondelle; two being of the first class, one of the second, one of the third. A fifth—the Sfax—is tolerably far advanced. Three are on the stocks; but even these vessels are not deserving the name of "swift cruisers." The Sfax, and the three other cruisers of the same type under construction, will alone unite all the conditions of "insubmergibility" which make the true vessel of war.

The insufficiency of our fleet with regard to swift cruisers is notorious; and it is necessary to put an end to this as soon as possible. We must remember that the Esmeralda Chilian cruiser, recently constructed in England, steams 18·5 knots, that Italy has under construction three vessels of this model, and that the great transatlantic

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Extracts from Report of French Commission—continued.

steamers of England, that could be transformed into cruisers in case of war, steam 19 and 20 knots. It is requisite, therefore, to provide our fleet with cruisers of a speed of 19 knots.

We do not think it necessary to review the other types of vessel, which are so numerous in our fleet; all these vessels, "sorte de pouissière navale," are due to the requirements of our extensive Colonial system, but they add nothing to our Naval strength. It would be desirable to seek a "modus vivendi," by charging to our great possessions in Africa and Asia the sums expended in maintaining order and security there, in order to reserve exclusively for our fleet the annual resources of the Naval Budget.

With regard to ships in reserve, we are glad to see that, by decree of the 13th of July, 1884, it was decided that two days after the order for commissioning, ships in the first reserve should be ready to put to sea, and in fighting order; those in the second reserve should be ready in ten days; and those in the third in twenty days.

In 1886, there will be two ironclads in the first reserve; nine ironclads and one transport, in the second; and twenty-seven vessels of various kinds in the third. It is evident that the number of ships in the first reserve is insufficient, and that we must put a larger number of vessels in that category.

Torpedo Boats.

Our torpedo boats, and submarine modes of defence, are altogether insufficient for the defence even of Cherbourg, Brest, L'Orient, Toulon, and Rochefort, to say nothing of our coasts and commercial harbours, in the docks of which such enormous wealth has accumulated.

We have at the present time only 64 torpedo boats absolutely completed, 12 of the first class, 48 of the second, and 4 torpedo vedette boats. We have under construction 8 torpedo gunboats, and 9 sea-going torpedo boats.

We require at least 100 torpedo boats to defend our arsenals.

Although the defence of the rest of our coast is the duty of the War Department, it is obvious that, in the case of a Naval war, the assistance of the Navy would be necessary for the defence of the commercial ports and other points of the coast that could be attacked.

For this duty the number of torpedo boats required may be estimated at 100.

We should thus require an available force of at least 200 torpedo boats.

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Extracts from Report of French Commission—continued.

The organization of the defence of some of our Colonial possessions is as necessary as the defence of our arsenals. It is indispensable for the Naval power of France to possess in all seas safe spots where her fleet can refit with coal and other stores. We have elsewhere remarked the difficulties we have experienced in obtaining supplies of coal owing to the vigorous enforcement of the "Enlistment Act."

The campaign in the extreme East has demonstrated the necessity of our having in the China Seas an arsenal and coal depôts.

The numerical insufficiency of *materiel* and of the *personnel* of the Navy has been established. The expedition of Tonquin has been an opportunity for our sailors to show their skill and valour. May it open the eyes of the Government to the real position of our naval *materiel* and of the supply of our Naval officers! It is the duty of the Government to supply such sailors with weapons worthy of their devotion and of their courage.

Electric Light.

The protection of armourclads by means of the electric light has not given very favourable results. On the 18th and 19th of March last, in the Squadron of Evolutions in the Mediterranean, an attack was made on ironclads by torpedo boats.

Admiral Duperré, the Commander-in-Chief of the squadron, reported as follows:—"The opinion is almost unanimous that on the night of the 18th the torpedo boats would have really succeeded in their attack, but that on the night of the 19th they were perceived in sufficient time for the guns in the ship to have paralysed their action." He goes on to report as follows:—The electric light, though extremely useful for a neighbouring ship, is very inconvenient for the ship which employs it. If the light is permanent and fixed, it protects a certain zone, which cannot be passed without discovery, but it also acts as a lighthouse for the enemy, who can keep outside of its rays. If the light is intermittent and movable, no zone is absolutely protected. Moreover, it is impossible to guard against those atmospheric changes which make the rays of the electric light almost useless.

Cellular Partitions.

Efforts are now being made to replace armour-plating by the establishment of a cellular partition, forming a coffer-dam from one end of the ship to the other, at a suitable height above and below the line of flotation.

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Extracts from Report of French Commission—continued.

The Italians have constructed vessels of war on this system, and we are employing it, to a certain extent, for the protection of the Sfax, and other cruisers.

The greater part of our ships are of wood, and unprovided with water-tight compartments, they would, therefore, be at the mercy of the torpedo. It is true that other foreign navies are in the same condition.

If the opinion that it is necessary to continue the construction of armourclads is still maintained in the navies of France and other countries, we must be prepared to take part in a struggle of a new kind. After the competition of the gun and the armourplate, we shall have that between the torpedo boat and the armourclad—a struggle which will bring about a new and costly change in naval warfare.

Your Commission has examined this grave problem, with the view of hastening its solution, but it can only commend it to the consideration of the Minister and Council of the Admiralty.

In leaving to the Naval Department the responsibility of persisting in the construction of ironclads, your Commission, nevertheless, recommends the development of the greatest possible number of swift cruisers and torpedo boats. It demands, however, that no expense for a new armourclad shall be incurred before the express sanction of the Chamber has been obtained.

Torpedoes.

In commending to the Department the development of our torpedo flotilla, we invite it to consider also the important problem of the manufacture of the torpedo. At the present time we are dependent on Austria for our supply. The Germans manufacture torpedoes at the Schwartzkopf manufactory, the English have their manufactory at Woolwich: and Italy is building at Venice a manufactory for the same purpose.

It is to be feared that if we only have recourse to M. Whitehead's establishment we shall not possess for many years a complete store of this necessary weapon. The following is an extract from the Report of a Commission appointed to look into this matter:—"The Commission considers that it is for the interest of France to again undertake the experiments made at Indret some years ago, and only to order from M. Whitehead torpedoes in which improvements have been made by him or other powers. France ought not to be dependent on a stranger for material of such vast importance.

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Extracts from Report of French Commission—continued.

"The torpedoes made by M. Whitehead two or three years ago are much superior in point of finish and workmanship to those delivered now. This inferority is in a great measure due to the numerous types M. Whitehead is forced to make to satisfy the different powers. The staff has not increased in proportion to the work; the workmen, being unable to fix their attention on well-determined models, have somewhat lost their sleight of hand. M. Whitehead is too much occupied in inventing, and consequently the superintendence of the workshop is not all that can be desired. M. Schwarztkopf, on the contrary, strives to work after one model, to make all his torpedoes alike, and to deliver them as nearly perfect as possible."

By making our own torpedoes in France we should be able to preserve for our exclusive advantage any improvements we may introduce. Under the present system we are compelled to communicate these improvements to M. Whitehead, in order that he may apply them to the torpedoes he is making for us: consequently other countries profit by them.

The necessity of a torpedo manufactory being recognised, it remains to be determined where it is to be. It ought to be situated on the coast, and one is naturally led to choose the Mediterranean, because of its climate and absence of tide. The manufactory, moreover, would derive great advantage from the proximity of a naval arsenal, whose resources in personnel and material could be utilised. The choice of the port of Toulon for a torpedo manufactory is amply justified. We take this opportunity of insisting on the necessity of having greater recourse to the private establishments of the country. Our Budgets, and particularly our Naval Budgets, have for a long time been loaded with expenses resulting from the custom of performing in our dockyards work that ought to be done in private establishments. It is absolutely requisite to guard against this tendency, for it is disadvantageous alike to the Treasury and to the development of the national resources.

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Extracts from Report of French Commission—continued.

ARTILLERY IN FRANCE AND ABROAD.

Our artillery compares favourably with English, German, or Italian, as will be seen from the following Tables:—

FRENCH.

Description of Gun.		Calibre.		Calculated thickness of iron plate pierced by gun, point blank fire.	
	SERVICE GUNS.				
		Millimetres.	Inches.	Centimetres.	Inches.
16 centimetres	Pattern 1870 Naval . .	164·7	(6·4)	22	(8·66)
	Patt. 1881 heavy . .	..		25	(9·84)
19 centimetres	Patt. 1870 . . .	194	(7·6)	21	(8·26)
24 centimetres	Patt. 1870 . . .	240	(9·4)	28	(11·02)
27 centimetres	Patt. 1870 . . .	274	(10·7)	34	(13·38)
	Patt. 1870 Naval . .	..		40	(15·74)
27 centimetres	No. 1 patt. 1875 . .	274·4	(10·8)	42	(16·53)
	No. 2 „ 1875 . .	..		37	(14·57)
	No. 1 „ 1875 Naval .	..		46	(18·11)
32 cent. (coast)	Short patt. 1870 . .	320	(12·5)	41	(16·14)
	Patt. 1870 . . .	..		48	(18·89)
	Patt. 1870–79 . . .	..		51	(20·07)
34 centimetres	Patt. 1875 short . .	340	(13·3)	55	(21·65)
	Patt. 1875 long . .	..		58	(22·83)
42 centimetres	Patt. 1875 . . .	420	(16·5)	84	(33·07)
	GUNS IN CONSTRUCTION.				
		Millimetres.	Inches.	Centimetres.	Inches.
16 centimetres	Patt. 1881, No. 2 . .	164·7	(6.4)	23	(9·05)
42 centimetres	Patt. 1881 . . .	240	(9·4)	46	(18·11)
27 centimetres	Patt. 1881 . . .	274·4	(10·8)	55	(21·65)
	Patt. 1870–81 (coast) .	..		46	(18·11)
32 centimetres	Patt. 1870–81 (coast) .	320	(12·5)	62	(24·41)
34 centimetres	Patt. 1875 M. . . .	340	(13·3)	66	(25·98)
	Short patt. 1881 . .	..		66	(25·98)
	Long patt. 1881 . .	..		76	(29·92)
37 centimetres	Patt. 1875–79 . . .	370	(14·5)	90	(35·43)

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ENGLISH.

Description of Gun.	Calibre.		Calculated thickness of iron plate pierced by gun, point blank fire.	
MUZZLE-LOADING GUNS.				
	Millimetres.	Inches.	Centimetres.	Inches.
64-pounder of 71 cwt.	160	(6·3)	12	(4·72)
64-pounder of 64 cwt.	160	(6·3)	13	(5·11)
7-inch of 90 cwt.	177·8	(7)	15	(5·9)
7-inch of 6 tons	177·8	(7)	18	(7.08)
7-inch of 7 tons	177·8	(7)	18	(7·08)
8-inch of 9 tons	203·2	(8)	21	(8·26)
9-inch of 12 tons	228·6	(9)	25	(9·84)
10-inch of 18 tons	254	(10)	30	(11·81)
11-inch of 25 tons	279·4	(11)	33	(13)
12-inch of 25 tons	304·8	(12)	33	(13)
12-inch of 35 tons	304.8	(12)	37	(14·57)
12·5-inch of 38 tons.	317.5	(12·5)	46	(18·11)
16-inch of 80 tons	406·4	(16)	74	(29·13)
BREECH-LOADING GUNS OF NEW PATTERN.				
	Millimetres.	Inches.	Centimetres	Inches.
6-inch of 81 cwt.	152·4	(6)	21	(8·26)
6-inch of 89 cwt.	152·4	(6)	26	(10·23)
8-inch of 11 tons (No. 1)	203·2	(8)	37	(14·57)
8-inch of 11 tons (No. 2)	203·2	(8)	39	(15·35)
8-inch of 12 tons	203·2	(8)	37	(14·57)
8-inch of 13 tons	203·2	(8)	39	(15·35)
9·2-inch of 18 tons	233·7	(9·2)	45	(17·71)
9·2-inch of 19 tons	233·7	(9·2)	54	(21·25)
10-inch of 26 tons	254	(10)	65	(25·59)
12-inch of 43 tons	304·8	(12)	65	(25·59)
12-inch of 46 tons	304·8	(12)	83	(32·67)
13-inch of 63 tons	342·9	(13)	97	(38·19)

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GERMAN.

Description of gun.		Calibre.		Calculated thickness of iron plate pierced by gun, point blank fire.	
		Millimetres.	Inches.	Centimetres.	Inches.
15 centimetres	Jacketed .	149·1	(5·8)	13	(5·1)
	Short-hooped .	..		14	(5·5)
	Long-hooped .	..		17	(6·6)
17 centimetres	Short-hooped .	172·6	(6·7)	15	(5·9)
	Long-hooped .	..		21	(8·2)
21 centimetres	Short-hooped .	209·3	(8·2)	21	(8·2)
	Long-hooped .	..		25	(9·8)
24 centimetres	Short-hooped .	238	(9·3)	35	(13·7)
	Long-hooped .	235·4	(9·2)	29	(11·4)
26 centimetres	Short-hooped .	262·5	(10·3)	36	(14·1)
	Long-hooped .	..		37	(14·5)
28 centimetres	Hooped .	283	(11·1)	40	(15·7)
30 c. 5 millim.	Short . .	305	(12)	55	(21·6)

If we compare by these Tables the guns absolutely in use in France, England, and Germany, the advantage in power of penetration is in favour of France. The French guns, moreover, fire steel projectiles, which are subjected before use to the most rigorous tests, while the English and most of the German guns fire hard iron projectiles, which break up against the sides of ironclad ships.

Extraordinary results have recently been obtained in France with steel shells of 34 centimetres, manufactured at Unieux (J. Holtzer); with these plates of 40 centimetres in Creusot steel have been penetrated, the projectile remaining intact. We have not heard of similar results having been obtained in any other country. If we examine the results obtained by guns already in the service of equal weight —i.e. the 16 cm. mod. 1881, No. 1 French, the 6-inch English, and the 15 cm. German, it will be seen that these three guns are almost equal. If we admit the figures given in the preceding Table, the English gun in course of construction would appear a trifle superior; but it must be recollected that these guns have never been tried, and that the results will probably fall short of the estimate. To complete the comparison with foreign artillery, it is necessary to refer to the guns which form the armament of the Italian ships Duilio, Dandolo, Italia, and Lepanto. The guns of the first two ships weigh 100 tons; they are muzzle-loaders, of a calibre of 43 cm.; their power of penetration is inferior to our gun of 42 cm., which only weighs 73 tons. Their projectiles, moreover, are made of hard iron, and break

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Extracts from Report of French Commission—continued.

up against the thickest armour plates. The new guns ordered for the Italia, Lepanto, &c., are breech-loaders; they are longer than the muzzle-loaders, and will have a greater power of penetration.

With regard to coast defence, whereas England and Germany have adopted their heaviest guns, France has not, up to the present time, employed guns of more than 32 cm. to arm her batteries along the coast; but, after an understanding with the Secretary of State for War, there will be no difficulty in rapidly obtaining guns of 42 cm., at least as powerful as those used by our neighbours.

To sum up, the French guns actually in the service are superior to those of England and Germany. The guns of the three countries in course of construction or recently adopted are nearly equal. With regard to the number of the guns of the new type already constructed, the French Navy holds the first place; for she possesses actually on board her ironclads or on the coast 35 steel guns of calibres of 27, 32, and 34 cm. She has besides in course of construction a large number of guns of different calibres after the models 1875 and 1881.

No difficulty is experienced in obtaining gun-carriages in iron, steel, or bronze. They are constructed in the private establishments of M. Farcot, "La Société des Forges et Chantiers de la Mediterranée," and in the "Creusot" establishment, the plans being approved by the Admiralty, and the work carried on under the inspection of a naval officer.

Coast Defence.

A Committee appointed November, 1881, by M. Gougeard, recommended the creation of an auxiliary force to be commanded by Naval officers, and who should act in concert with a numerous fleet of torpedo boats for the defence of the coast. The Commissioners of the Maritime Inscription are the recruiting officers for the Navy, but they might well be replaced by executive officers. These latter could equally well direct inquiry into cases of shipwreck, and look after the interests of the maritime population, and, in addition, they could be charged with the organisation for the defence of the coasts in time of war. They could organise a *personnel* thoroughly acquainted with the locality, sufficiently drilled, and capable of rendering in time of war services it would be impossible to expect from men sent to the spot at the last moment. The defence of the five military ports is entrusted to Naval officers and to retired engineers, who have gained a certificate for knowledge of submarine means of defence. As no

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Extracts from Report of French Commission—continued.

effective list has been fixed, each port sends most of its old officers to Bay Ardville, to obtain for them the pecuniary advantages attached to the certificate of fitness. As the majority of these veterans cannot be employed in torpedo service, on account of their other duties, they soon lose the advantages of the special training that they have received. Out of 571 appointments, only 185 officers were found capable of acting in the torpedo service; we thus find 386 men in receipt of Government pay without the least advantage to the Navy, and whose very existence in time of war would be a source of danger.

The corps has not been submitted to any organisation, or to any programme. No measure has been taken to insure its technical instruction. Each port has its own traditions.

The Commission presided over by Admiral Dupetit-Thouars has reported in favour of a more decided organisation of this torpedo corps.

The service of automatic torpedoes is to be entrusted to a Naval torpedo officer, and their custody and repair to engineers.

Naval officers should be charged with the duty of the general inspection of the fixed and moveable defence of the five ports, at periods to be determined each year by the Minister.

Composition of the Fleet.

The problem to be solved is the following: given that a torpedo boat, with a crew of twelve men, which costs say £12,000, has a good chance of destroying an ironclad worth £1,000,000 sterling, and carrying a crew of 600 men, ought we to continue the construction of these monster ships? The advocates of the torpedo maintain that the torpedo boat has conquered the ironclad. M. Gougeard, however, considers that the victory of the torpedo boat will only last until the fighting vessel has obtained a speed equal to that of the torpedo boat. "When the fighting vessel," he says, "shall have attained the same speed as the torpedo boat, the latter is condemned to disappear, or rather we should say that the fighting ship has herself become the sole instrument of Naval combat."

Meanwhile the former Minister proposes to construct a type of vessel whose principal aim shall be to realise the greatest possible speed.

Admiral Aube, the Minister of Marine, has reported to the Commission that no foreign Power has ceased to consider the ironclad the

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Extracts from Report of French Commission—continued.

great fighting element. Doubtless events have shown that a ship at anchor attacked during the night, can be certainly sunk by a torpedo, but it is certainly not the same with a ship in motion. There is no doubt that it is necessary to increase the number of torpedo boats, and to consider them engines of defence of the first order, capable of exercising under the wing of large vessels all their power. But this protection is indispensable to them, and therefore the big ironclad will always be a necessary force. The Minister has concluded by remarking that the Naval Budget should always provide for twelve large ironclads ready to be put in commission. As for torpedo boats, great numbers are requisite, not only on the Coast of France, but also in Algeria and in our Colonies.

The President of the Budget Commission epitomised the views of M. Aube, the present Minister of Marine, as follows:—It is not necessary to indicate the time when the construction of large ironclads will cease, nor to give up these ships, as all other Maritime Powers continue to build them. The ironclad does not, in the way of progress, lag behind the torpedo boat, and if we succeed in finding a protection for the ironclad, the torpedo boat will be annihilated.

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French Estimates, 1887.

The total amount demanded for the service of the year 1887, is £7,808,800

As compared with Estimate for 1886, of . . . 8,043,296

Showing a reduction of £235,496

The reduction is chiefly due to the suspension of works in construction of certain armoured vessels and transports, and to economy to be effected in repairs, owing to the number of old vessels struck off the effective list.

The principal decreases are in the following Votes:—

	£
Less required for Wages of Yard Workmen	52,000
„ „ Stores for Naval Construction . . .	73,440
„ „ Ordnance Stores	55,676
„ „ Wages of Seamen	10,704
„ „ Provisions for Seamen	18,360
	£210,180

The following Note is appended to the Projet.

"The greater part of this reduction is due to suspension of work on certain ironclads and transports; but if the experiments now being made in the offensive and defensive qualities of torpedo boats should not give the anticipated results, the amounts struck out of the Projet would be reinserted in the Estimates."

The sums proposed for construction of new vessels in 1887 are as follows:—

	£
Construction of Armoured Vessels	519,300
„ Armoured Gunboats	80,740
„ Unarmoured Vessels	589,960
	£1,190,000

The feature of the Admiralty proposals is the construction of no less than fifty-one torpedo boats during the coming financial year. The estimates provide for work upon six ironclads, L'Amiral Baudin, Neptune, Formidable, Hoche, Magenta, and Marceau; four armour-clad gunboats, each intended to bear four heavy guns, the Cocyte, Phlégéton, Styx, and Grenade; two spar-deck cruisers (*croiseurs à batterie*), the Tage and the Cécille; three torpedo cruisers, the Epervier, the Faucon, and the Vautour; two aviso transports, the Manche and the Vaucluse; two despatch boats, the Fulton and Jouffroy; fifty-one torpedo boats; two sailing frigates, the Andromède and Melpomène; and one transport, Le Drôme.

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THE FOLLOWING SHIPS APPEAR IN THE PROGRAMME FOR NEW CONSTRUCTION FOR 1887:—

Name	Class.	Where building.	Estimated Progress on 1st January, 1887.	Estimated Progress on 1st January, 1888.
ARMOURED VESSELS.			Hundreds.	Hundreds.
Amiral Baudin	Armourclad	Brest	80	Complete
Neptune	,, ,,	,,	51	67
Formidable	,, ,,	Lorient	79	Complete
Hoche	,, ,,	,,	56	70
Magenta	,, ,,	Toulon	33	51
Marceau	,, ,,	La Seyne	73	93
Cocyte	Armoured gunboat, 1st Class	Cherbourg	80	Complete
Phlégéton	,, ,,	,,	49	89
Styx	,, ,,	,,	27	67
Grenade	Armoured gunboat, 2nd Class	Lorient	70	Complete
UNARMOURED SHIPS.				
Tage	Deck-protected Cruiser	St. Nazaire	35	65
Cécille	,, ,,	La Seyne	30	60
Epervier	Torpedo Cruiser	Rochefort	70	Complete
Faucon	,, ,,	Toulon	75	Complete
Vautour	,, ,,	,,	71	Complete
Fulton	Despatch Boat	Lorient	73	Complete
Jouffroy	,, ,,	,,	82	Complete
Manche	Aviso Transport	Cherbourg	27	67
Vaucluse	,, ,,	,,	28	84
Andromède	Sailing frigate	Lorient	41	67
Melpomène	,, ,,	Rochefort	64	Complete
Le Drôme	Transport	St. Claparède	80	Complete
51 Torpedo boats	1st class	Contract	*	Complete

* 30 of these Boats to be advanced to $\frac{85}{100}$ on 1st January, 1887.
10 " " $\frac{40}{100}$ "
6 " " $\frac{50}{100}$ "
5 " " $\frac{60}{100}$ "

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ABSTRACT OF FRENCH NAVY

		1876.	1877.	1878.	1879.
		£	£	£	£
1	Central Administration	53,044	53,044	52,192	55,484
2	Hydrographic Office	19,784	19,784	22,404	20,732
3	Officers and Seamen afloat and ashore	1,622,484	1,622,478	1,745,332	1,775,450
4	Barracks for Seamen				
5	Naval School				
6	Troops	579,348	543,556	556,672	547,912
7	Maritime Gendarmerie				
8	Barracks for Troops				
9	Dockyard and other Civilian Officers and Staff	159,456	160,408	177,584	185,944
10	Leading Men, Police, Firemen, &c.	103,312	102,760	106,052	106,320
11	Provisions	958,448	928,100	962,552	982,300
12	Hospitals				
13	Wages—	797,500	831,148	880,048	957,860
	Naval Construction. Manufacture of Stores	..	..	..	..
	Naval Construction. New Constructions	..	..	..	..
	Naval Construction. Repairs	..	..	..	..
	Naval Construction. General Service	..	..	..	..
	Naval Construction. Purchase of Stores, and Ships built by Contract	1,924,636	2,141,012	2,600,964	2,338,186
14	Hydraulic Works and Buildings	229,512	359,568	392,060	409,332
15	Ordnance Stores and Wages *	..	..	..	..
16	Maritime Justice	10,376	10,376	9,456	9,456
17	Books and Printing	14,232	15,592	16,312	19,792
18	Travelling Expenses	..	..	..	..
19	Sundries	153,352	175,540	184,140	200,412
20	Secret Service	..	..	..	..
21	Maritime Inscription, Fisheries, &c.	..	..	..	..
	Grant to the "Caisse des Invalides"	..	..	..	..
		6,625,484	6,962,466	7,705,768	7,609,180
	Abate—Balance unexpended	58,376	91,636	101,128	262,688
		6,567,108	6,870,830	7,604,640	7,346,492

* Previous to 1882 included under sub-head 13.

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ESTIMATES, FROM 1876 TO 1886.

1880.	1881.	1882.	1883.	1884.	1885.	1886.
£	£	£	£	£	£	£
56,712	53,692	54,016	58,905	50,354	54,192	54,144
20,732	20,732	20,760	20,761	20,265	19,720	19,720
			1,827,217	1843,460	1803,256	1,791,088
1,697,196	1,715,056	1,752,996	8,305	8,072	5,968	5,968
			9,206	10,176	10,172	10,172
			533,307	544,862	562,668	552,136
557,064	569,848	569,476	38,333	38,333	38,332	37,244
			40,015	39,340	36,952	36,952
193,932	206,732	216,152	206,526	198,605	189,292	188,884
114,488	117,240	117,252	118,169	132,140	126,076	127,592
819,632	800,976	770,796	807,831	824,763	814,064	799,348
129,040	132,436	132,964	124,363	120,427	112,532	121,232
987,976	985,649	..	..	..	..	..
..	..	98,600	102,600	116,655	111,200	111,200
..	..	277,000	328,000	345,140	312,000	312,000
..	..	197,052	157,054	157,585	156,000	156,000
..	..	304,180	289,620	261,988	246,240	245,988
2,308,624	2,426,804	1,342,628	2,190,141	1,963,245	1,921,448	1,921,440
454,092	416,608	235,200	437,200	367,732	372,948	372,920
..	..	359,492	681,083	653,344	773,276	773,228
9,456	9,072	9,036	9,039	9,000	9,000	8,940
22,492	24,756	26,280	26,280	25,724	22,984	22,984
..	..	150,000	150,683	145,160	144,000	154,352
164,228	213,723	30,000	30,395	28,760	27,016	27,016
..	..	..	..	2,600	2,600	2,600
..	..	1,720	2,839	3,488	3,488	3,488
..	..	..	..	..	..	186,620
7,535,664	7,693,324	6,655,600	8,197,872	7,911,218	7,575,424	8,043,296
262·272	128·396	379,416	116,800	Not known.	Not known.	Not known.
7,273,292	7,564,928	6,276,184	8,081,072	7,911,218	7,575,424	8,043,296

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List of French Ships in Commission,

WITH THEIR STATIONS, ON 25TH MARCH, 1886.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Actif	Despatch boat	4	Audic, L. V.	Algiers.
Adour	Transport	—	Sales de Banières, C. F.	Div. Tonkin.
Africain	Hulk	—	Drouin, C. F.	Sénégal.
Alcyone	Cutter	2	Mallet, L. V.	Granville.
Albatros	Despatch boat	2	D'Aboville, L. V.	Gabon.
Alceste	Sailing frigate	4	Pradier, C. F.	Gabon.
Alerte	Gunboat	2	Dantin, L. V.	Tonkin.
Allier	Transport	4	Lormier, L. V.	New Caléd.
Alouette	Despatch boat	3	Feyzeau, L. V.	Saïgon.
Amiral-Duperré	Ironclad	14	Barrera, C. V.	Squadron.
Annamite	Transport	2	Aymes, C. F.	Partic. Service.
Atalante	Station ironclad	12	Han Cléry	Saïgon.
Ardent	Despatch boat	2	Raffenel, L. V.	Sénégal.
Aoraï	Schooner	2	Reux, L. V.	Tahiti.
Ariège	Transport	—	Verninac, L. V.	Partic. Service.
Arquebuse	Gunboat	6	Gilbert, L. V.	Tonkin.
Aspic	Gunboat	4	Rupé, L. V.	China.
Austerlitz	Cadet school	4	De Kervereguin, C. V.	Brest.
Avalanche	River gunboat	2	De Romain, L. V.	Tonkin.
Baïonnette	Gunboat	2	Jourden, L. V.	Cochinchina.
Basilic	Despatch boat	2	Nicolas, L. V.	Gabon.
Berthe de Villers	River gunboat	2	D'Hespel, L. V.	Tonkin.
Bien-Hoa	Transport	2	Lecoat St. Haouen, C. F.	
Bisson	Despatch boat	4	Poudra, C. F.	India.
Borda	Naval school	—	Sallandrouze de Lamornaix, C. V.	Brest.
Bobillot	Gunboat	2	Arden, L. V.	Tonkin.
Bouclier	River gun	2	De Mazenod, L. V.	Cochinchina.
Bourayne	Cruiser	6	Villemsens, L. V.	Pacific.
Bourrasque	Gunboat	2	Kerlero du Crano, L. V.	Tonkin.
Bouvet	Despatch boat	4	De Brétizel, C. F.	Antilles.

* Extracted from *Journal de la Marine le Yacht*, 27th March, 1886. † Flagships.

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LIST OF FRENCH SHIPS IN COMMISSION *—*continued.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Brandon . .	Despatch boat .	2	De Marliave, L. V. . . .	Tonkin.
Bretagne . .	School for boys.	—	Philippe, C. V. . . .	Brest.
Bruat . . .	Despatch boat .	4	Marquis, C. F. . . .	New Caledonia.
Capricorne . .	Gunboat . .	4	Bongrain, L. V. . . .	Indian Ocean.
Carabine . .	River gun. .	12	Devic, L. V. . . .	Tonkin.
Caravane . .	Transport .	4	Davin, L. V. . . .	French Coast.
Carreau . .	River gun. .	2	Gilbert, L. V. . . .	Tonkin.
Casse-Tête . .	River gun. .	2	Herbert, L. V. . . .	Tonkin.
Chacal . .	Gunboat . .	2	Brion, L. V. . . .	Indian Ocean.
Champlain . .	Cruiser . .	10	Daniel (P. J.), C. F. . .	China.
Chasseur . .	Despatch boat .	2	Legorrec, C. F. . . .	Tonkin.
Cigale . .	Despatch boat .	6	De Marcetteau de Brem, L. V.	Sénégal.
Colbert † . .	Ironclad . .	18	De Courthille, C. V. . .	Evolutionary Squad.
Comète . .	Gunboat . .	4	Noirot, F. V. . . .	Tonkin.
Corrèze . .	Transport .	2	Vranken, C. F. . . .	Indian Ocean.
Corse . . .	Despatch boat .	4	Sicard, L. V. . . .	Toulon.
Courbet . .	Ironclad . .	8	Valessie, C. V. . . .	On Trial at Toulon.
Couronne . .	Gunry. sch. ship	36	Augey-Dufresse, C. V. . .	Hyères.
Cuvellier . .	Gunboat . .	4	Barry, L. V. . . .	
Cuvier . .	Despatch boat .	4	Aubry de la Noé, C. F. .	Granville.
Decrès . .	Cruiser . .	10	De Montesquiou Fezensac, C. V.	Pacific.
Desaix . .	Cruiser . .	4	Lejard, C. F. . . .	Toulon.
Dévastation . .	Ironclad . .	14	Le Bourgeois, C. V. . .	Evolutionary Squad.
Dives . . .	Transport .	2	Legrand, L. V. . . .	New Caledonia.
Dordogne . .	Transport .	4	Caillet, C. F. . . .	
Doucet . .	Gunboat . .	2	Andréani, L. V. . . .	Tonkin.
Duchaffaut . .	Cruiser . .	6	Gourdon, C. F. . . .	New Caledonia.
Dumont d'Urville .	Despatch boat .	4	Blouët, C. F. . . .	Atlant. South.
Dupetit-Thouars .	Cruiser . .	10	Foret, C. F. . . .	Brest.
Duquesne . .	Cruiser . .	21	Fournier, C. V. . . .	Pacific.
Éclair . . .	Despatch boat .	2	Thomine, L. V. . . .	Tonkin.
Élan . . .	Despatch boat .	2	Cordier, L. V. . . .	School of Pilots.
Éperlan . .	Cutter . .	4	De St. Blancard, L. V. .	Channel.
Étoile . . .	Gunboat . .	4	Le Forestier, L. V. . .	Atlant. South.
Escopette . .	River gunboat.	1	Adam, L. V. . . .	Cochinchina.
Estoc . . .	River gunboat.	2	Lemogne, L. V. . . .	Tonkin.
Européen . .	Transport .	2	Charpentier, C. F. . .	Partic. Service.
Fabert. . .	Cruiser . . .	8	Cochet, C. F. . . .	Pacific.

* Extracted from *Journal de la Marine le Yacht*, 27th March, 1886. † Flagships.

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LIST OF FRENCH SHIPS IN COMMISSION *—*continued.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Fanfare	Gunboat	2	Sauvan, L. V.	Saïgon.
Flore †	Cruiser	14	d'Abel de Fibran, C. V.	Atlant. North.
Forfait	Cruiser	15	Wyts, C. V.	Indian Ocean.
Framée	River gunboat	1	Delescharnps, L. V.	Cochinchina.
Friedland	Ironclad	16	Béhic, C. V.	Evolutionary Squad.
Fulminant	Coast defence	6	Véron, C. V.	Toulon.
Gabès	Gunboat	2	Arnoux, L. V.	Atlant. South.
Garnier	River gunboat	2	Le Golleur	
Gironde	Transport	2	Henriot, C. F.	Partic. Service.
Goeland	Despatch boat	2	Frogé, L. V.	Sénégal.
Gogah	Despatch boat	2	Destephen, L. V.	Cochinchina.
Guichen	Despatch boat	2	Le Pord, L. V.	Gabon.
Henri Rivière	River gunboat	2	Baudens, L. V.	Tonkin.
Héron	Despatch boat	2	Néron, L. V.	Sénégal.
Hirondelle	Cruiser	3	Jayet de Gercourt, C. F.	Evolutionary Squad.
Hussard	Despatch boat	4	Gatier, C. F.	Tunis.
Hugon	Cruiser	6	Touchard, C. F.	Tonkin.
Hyène	Gunboat	2	Bernard, L. V.	Tonkin.
Infernet	Cruiser	10	De Cuverville, C. V.	Atlant. South.
Iphigénie	Cruiser	20	Besnard, C. V.	School Ship.
Isère	Transport	1	Lespinasse de Saune, L. V.	French Coast.
Jacquin	Gunboat	2	Carpentier, L. V.	Tonkin.
Jaguar	Gunboat	2	Adigard, L. V.	Cochinchina.
Japon	Trpdo. sch. ship	2	Servan, C. F.	Toulon.
Javelot	River gunboat	2	Schilling, L. V.	Bidassoa.
Kep		—	De la Bonninière de Beaumont, C. V.	Tonkin.
Labourdonnais	Despatch boat	3	De Bausset, C. F.	Indian Ocean.
La Clocheterie	Cruiser	10	De Barbeyrac, C. F.	China.
Lapérouse	Cruiser	15	Méquet, C. V.	Indian Ocean.
Laprade	Despatch boat	2	Maudet, L. V.	Gabon.
Léopard	Gunboat	2	Vivrier, L. V.	Tonkin.
Levrard	Gunboat	2	Surcouf, L. V.	
Limier	Cruiser	6	De Cornulier, C. F.	Indian Ocean.
Lion	Gunboat	4	Lamson, L. V.	Tonkin.
Lionne	Gunboat	3	Corrard, L. V.	Tonkin.
Loyalty	Despatch boat	2	De Chappedelaine, L. V.	New Caledonia.
Lutin	Gunboat	4	Duval (R.), L. V.	Tonkin.
Lynx	Gunboat	4	Bonnaire, L. V.	Taïti.

* Extracted from *Journal de la Marine le Yacht*, 27th March, 1886. † Flagships.

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List of French Ships in Commission *—*continued.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Magellan	Transport	6	Pouvreau, C. F.	Partic. Service.
Magon.	Cruiser	15	Puech, C. V.	Pacific.
Massue	River gunboat	2	Barnaud, L. V.	Tonkin.
Mésange	Despatch boat	2	Nayel, L. V.	Gabon.
Messager	Trpdo. sch. ship	—	Godin, C. V.	Boyardville.
Météore	Gunboat	4	Latour, L. V.	Levant.
Milan	Cruiser	2	Valery, C. F.	Evolutionary Squad.
Mitrailleuse	Gunboat	1	Senès, L. V.	Tonkin.
Moselle	Transport	2	Vicel, L. V.	Partic. Service.
Mouette	Despatch boat	4	Bayle, C. F.	Channel.
Moulun	Gunboat	2	De Surgy. L. V.	Tonkin.
Mousqueton	River gunboat	2	Lapied, L. V.	Tonkin.
Mutine	Gunboat	2	Hallez, L. V.	Tonkin.
Nagotna	Despatch boat	2	Kiésel, L. V.	Tonkin.
Naïade †	Cruiser	20	Littré, C. V.	Indian Ocean.
Navarin	Transport	9	D'Estienne, C. V.	New Caledonia.
Nielly.	Cruiser	15	Dorlodot des Essarts, C. V.	Madagascar.
Nièvre.	Despatch boat	4	Quénu, L. V.	Tonkin.
Nive	Transport	—	Bienvenue	Partic. Service.
Nu-hiva	Schooner.	—	Leudet-Delavallée, L. V.	Marquises.
Olumo.	Despatch boat	—	Le Deuc, L. V.	Gabon.
Orohéna	Schooner.	2	Giraud, L. V.	Tahiti.
Oyapock	Despatch boat	2	Monge, L. V.	Guyane.
Perle	Schooner.	2	Sant-Paul de Sincay, L. V.	Brest.
Pétrel	Despatch boat	4	De Calan, L. V.	Constantinople.
Pionnier	River gunboat	4	Moussu, L. V.	Gabon.
Pique	Gunboat	2	Bellue, C. F.	Indian Ocean.
Pluvier	Despatch boat	3	Poidloue	Tonkin.
Pourvoyeur	Despatch boat	1	Leclerc, L. V.	Gabon.
Primauguet	Cruiser	15	Buge, C. V.	China.
Provençale	Hulk	—	Tajasque, L. V.	Toulon.
Rafale.	Gunboat	2	Babeau, L. V.	Tonkin.
Redoutable	Ironclad	14	Mac. Guckin de Slane	Evolution Squad.
Redoute	Gunboat	2	Muller, L. V.	India.
Reine Blanche †	Station ironclad	12	De Jonquières, C. F.	Home.
Résolue	Frigate	8	Gourdan, C. V.	School Ship.
Revolver	Gunboat	1	De Balincourt, L. V.	Tonkin.
Rig.-de-Genouilly	Cruiser	8	Richard, C. F.	Levant.
Roland	Cruiser	15	Mayet, C. V.	China.

* Extracted from *Journal de la Marine le Yacht*, 27th March, 1886. † Flagships.

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LIST OF FRENCH SHIPS IN COMMISSION *—*continued.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Romanche	Transport	4	Réver. égat, L. V.	India.
Sagaie	Gunboat	2	Terlier, L. V.	Cochinchina.
Sagittaire	Gunnery ship	4	Krantz, L. V.	China.
Saint-Louis	Gunnery ship	36	Dauge, C. F.	Tender to Couronne.
Salamandre	Despatch boat	6	Richard, L. V.	Sénégal.
Sané	Cruiser	6	Juge, C. V.	Levant.
Scorff	Transport	4	De Royer, L. V.	Taïti.
Scorpion	Gunboat	4	De Chauliac, L. V.	Indian Ocean.
Seudre	Transport	6	Simon, L. V.	Réunion.
Suffren	Ironclad	15	Forget, C. V.	Evolutionary Squad.
Talisman	Cruiser	4	Penaud, C. F.	Atland. North.
Taravao	Schooner	—	Masseron, L. V.	Tahiti.
Tarn	Transport	2	Delort, C. F.	Indian Ocean.
Tilsit	Hulk	—	Reveillère	Cochinchina.
Torpedo boat 44	Torpedo boat	2	Vignot, L. V.	Saïgon.
Tirailleuse	Gunboat	4	Lacourné, L. V.	India.
Travailleur	Despatch boat	4	Arnous, L. V.	Rochefort.
Trombe	Despatch boat	2	Gervaise, L. V.	Tonkin.
Turenne †	Ironclad	13	Dupuis, C. V.	China.
Vauban	Armoured cruiser	12	Maire, C. V.	Cherbourg.
Vaudreuil	Cruiser	13	Vincenot, C. F.	India.
Vénus †	Cruiser	14	Turquet	Levant.
Vigilant	Despatch boat	2	Eymery, L. V.	Guiana.
Vienne	Transport	—	Delaunay, L. V.	Partic. Service.
Vinh-Long	Transport	2	Talpomba, C. F.	Partic. Service.
Vipère	Gunboat	4	Boué de Lapeyrere, F. V.	China.
Volage	Despatch boat	1	Bonnet, L. V.	Taïti.
Voltigeur	Despatch boat	4	Dumont, C. F.	Atlan. South.

* Extracted from *Journal de la Marine le Yacht*, 27th March, 1886. † Flagships.

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German Navy Estimates.

Head of Service.	Proposed 1886–87.	Voted 1885–86.
	£	£
Admiralty	28,117	26,969
Hydrographical Department, including Observatory	19,050	18,738
Stations	11,274	11,049
Legal Expenses	1,387	1,387
Religious Ministration	2,180	2,022
Officers and crews	368,241	316,449
Maintenance of Ships in commission	304,490	229,476
Victuals	158,198	142,485
Clothing	4,834	5,290
Dockyard and Garrison	40,137	37,784
Lodging Allowances	31,200	28,400
Medical Service	27,751	27,396
Travelling expenses, Freight, &c.	17,350	15,400
Education	6,265	6,109
Yards wages, Maintenance and Naval Construction	708,066	649,779
Ordnance	97,519	97,406
Torpedo Service	27,232	24,642
Pilotage, Buoys, Beacons, &c.	9,375	9,413
Miscellaneous Expenses	7,703	6,102
Ordinary Estimate	1,870,369	1,656,296
Extraordinary Estimate.		
New construction	171,750	462,970
Torpedo Service	104,300	
Naval Ordnance	23,150	
New Works and Repairs of Buildings	254,495	
Total Estimate, Ordinary and Extraordinary	2,424,064	2,119,266

In 1884 a special vote of £840,000 was granted to be employed in the purchase of torpedo boats.

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German Navy Estimates—continued.

In a memorandum accompanying the proposal the Minister expressed the necessity for increasing the number of torpedo boats for coast defence and sea service to 150. It was estimated that 25 of these would be completed by the end of 1884, leaving 125 to be constructed in subsequent years.

Only a small portion of this sum of £840,000 has yet been expended; the balance is carried forward and is an addition to the ordinary and extraordinary votes of the current year.

THE FOLLOWING SHIPS ARE IN COURSE OF CONSTRUCTION.

(From Return No. 153, presented to the House of Commons 17 May, 1886.)

Name of Vessel.	Class.	Tons Displacement.	Speed.	Estimated Cost.
			Knots.	£
PROTECTED SHIPS.				
Ersatz Elizabeth .	Protected Cruiser .	4,500	18	225,000*
Ersatz Ariadne . .	„ „ .	4,800	18	240,000*
UNPROTECTED SHIPS.				
Charlotte . . .	Cruiser . . .	3,360	16	..
Alexandrine . .	Cruiser Corvette .	2,370	15	..
Arcona . . .	„ „ .	2,370	15	..
N.	„ „ .	1,400	..	60,000
N.	„ „ .	1,400	..	60,000
Ersatz Albatross . .	Cruiser . . .	900	..	..
N., Torpedo Vessel. .	. . . .	..	..	80,000
2 Torpedo Division Boats.	. . . .	..	..	29,000 each.
30 Torpedo Boats, over 100 ft. in length.				

* Exclusive of Armament and Torpedoes.

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Personnel.

Provision is made for the following numbers of Officers and Seamen :—

2	Vice-Admirals.
4	Rear-Admirals.
29	Captains.
53	Captains of corvettes.
102	Lieut.-Captains.
166	Lieutenants.
127	Sub-Lieutenants.
100	Naval Cadets.
43	Chief Engineer officers.
76	Medical officers.
45	Paymasters.
817	Warrant and Petty Officers.
86	Gunnery Officers.
830	Gunners.
5,864	Sailors.
470	Boys.
45	Musicians.
132	Officers and men for Artillery and Torpedo depôt.
1,065	Marine battalion.
3,050	Officers and Seamen employed in Naval Dockyards.
13,106	

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Austrian Navy Estimates.

Ordinary Estimates.

Head of Service.	Required for 1886.	Voted 1885.
	£	£
Pay, &c., of Officers	125,530	122,912
Wages, &c., of Seamen	109,600	109,600
Lodging and Service on Shore	55,263	53,356
Victuals, &c., Service Afloat	135,315	135,315
Hydrographical, Educational, and Hospital Establishments	21,425	20,924
Stores and Wages for Maintenance and Repair of Fleet	341,244	322,882
Naval Ordnance (including Ammunition)	338,864	320,302
Torpedoes	2,380	2,580
New Works and Hydraulic Machinery	21,490	21,106
Miscellaneous Expenses	32,805	28,385
Pensions	47,112	47,169
Total Ordinary Estimate	1,231,028	1,184,531
Extraordinary Estimates.		
Construction of New Vessels	162,750	142,300
Naval Ordnance	20,349	39,099
Fish Torpedoes	18,400	
Machinery	14,785	15,585
Miscellaneous Expenses	613	824
Total Ordinary and Extraordinary	1,447,925	1,382,339

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Austrian Navy Estimates—continued.

Provision is made in the Estimates for 1886 for Construction of the following Vessels.

(From Return No. 153, presented to House of Commons 17 May, 1886.)

Name of Vessel.	Class.	Tons Displacement.	Speed.	Amount provided in Estimates, 1886.
			Knots.	£
Kronprinz Erzherzog Rudolph .	Armoured Vessel	6,900	14	41,950
Ersatz Erzherzog Ferdinand Max	„ „	5,100	..	
Leopard	Torpedo Vessel .	1,530	18	48,800
Ersatz Seehund . . .	„ „	1,530	18	11,000
2 Torpedo Boats . . .	135 ft. in length .	..	..	52,000
8 Second Class Torpedo Boats .	over 100 ft. „	..	..	35,000
Total sum provided for New Construction in 1886 . .				208,750

Personnel.

Provision is made for the pay of the following Officers and Men:—

2 Vice-Admirals.
7 Rear-Admirals.
18 Captains.
48 Commanders.
192 Lieutenants.
159 Sub-Lieutenants.
163 Midshipmen and Cadets.
9 Chaplains.
66 Surgeons.
234 Engineers.
157 Commissariat.
45 Instructors, &c.
134 Other ranks.
7,340 Seamen, &c.

8,574 Numbers provided for in Estimates for 1886.

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Italian Navy Estimates.

No.	Head of Service.	Proposed. 1886-7.	Voted, 1885-6.
		£	£
	Admiralty Office	30,973	29,996
	Mercantile Marine	55,238	54,422
	Ships in Commission, Reserve, &c., Allowances to Officers and Men	145,600	148,000
	Commissioned Officers' Pay	93,973	91,103
	Engineer Officers, Constructive Staff	27,865	26,042
	Commissariat Officers	32,059	31,925
	Medical Officers	18,482	17,367
	Crews of Vessels	208,280	190,600
	Storekeepers and Accountant Officers	29,185	28,385
	Police	10,713	10,615
	Riflemen	9,860	9,860
	Victuals	176,046	163,266
	Watchmen and Lighting	4,659	4,179
	Naval Hospitals	10,520	9,640
	Medals and Special Pensions	1,080	1,200
	Coal and other Fuel	88,400	88,400
	Official Staff of Dockyards	6,657	5,611
	Naval Institute	19,072	17,347
	Scientific Branch	7,417	6,970
	Legal Expenses	1,200	1,200
	Freight, Transport, &c.	28,000	19,040
	Maintenance of Fleet, Stores	248,000	220,000
	„ „ Labour	172,000	140,000
	Naval Ordnance including Torpedoes	196,000	140,000
	New Works and Repairs	60,000	48,000
	Construction of New Vessels—Ordinary Vote	880,000	800,000
	Rent of Crown Property used by Government	90,674	89,405
	Extraordinary Estimate.		
	Construction of New Vessels	280,000	500,000
	„ „ Naval Arsenal at Taranto	44,000	68,000
	„ „ Dry Dock at Spezia	52,000	48,000
	„ „ Hydraulic Crane at Venice	..	6,000
	Defence of Coast	100,000	60,000
	Half Pay and Reserved Pay	4,640	4,400
	Imprest Account for Advances to Officers	80,000	60,000
	Total Estimates, Ordinary and Extraordinary	3,212,593	3,138,977

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Italian Navy Estimates—continued.

Maintenance of existing Fleet.

The value of the Italian Fleet is taken at £7,800,000. Six per cent. is considered the fair sum for cost of maintenance, but, as so many of the ships are new, £420,000 only is provided instead of the full sum of £468,000.

Artillery and Torpedoes
(except for first armament of new ships provided for under New Construction).

The present value of Ordnance Stores is estimated at £3,480,000. At 6 per cent. this would necessitate a charge of £208,800, but as most of the material is new, only £196,000 has been provided for maintenance.

The following Ships are now in course of Construction.

(From Return No. 153, presented to House of Commons 17 May, 1886.)

Name of Vessel.	Class.	Tons Displacement.	Speed.
			Knots.
ARMOURED VESSELS.			
Lepanto	Armoured Vessel	13,550	18
Re Umberto	,, ,,	13,251	..
Sicilia	,, ,,	13,251	..
Lauria	,, ,,	11,000	16
Morosini	,, ,,	11,000	16
Doria	,, ,,	11,000	16
Sardegna	,, ,,	13,298	..
UNARMOURED VESSELS.			
Etna	Deck-protected Cruiser	3,530	17
Vesuvio	,, ,,	3,530	17
Stromboli	,, ,,	3,530	17
Fieramosca	,, ,,	3,745	17
N.	Torpedo Vessel	2,000	19
Tripoli	,, ,,	741	20
Goito	,, ,,	741	20
Folgore	,, ,,	317	20
Saetta	,, ,,	317	20
Vessels to be commenced in 1886–87.			
Monzambano	Torpedo Vessel	741	20
Montebello	,, ,,	741	20
N.	,, ,,	..	..
N.	,, ,,	..	..
N.	,, ,,	..	..
N.	,, ,,	..	..
28 First Class Torpedo Boats, over 100 ft. in length.			

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Italian Navy Estimates—continued.

COMPARISON BETWEEN SHIPBUILDING AND ORDNANCE VOTES, 1886–87 AND 1885–86.

Italian Estimates.	1886–87.	1885–86.
New Construction . . .	1,160,000	1,300,000
Maintenance of existing Fleet .	420,000	360,000
Artillery and Torpedoes . .	196,000	140,000
Submarine Coast Defence . .	100,000	60,000
	1,876,000	1,860,000

NUMBER OF OFFICERS AND MEN PROVIDED FOR IN ITALIAN NAVY ESTIMATES.

	1886–87.	1885–86.
Admiral	1	1
Vice-Admirals	5	5
Rear-Admirals	11	11
Post Captains	34	34
Commanders	40	40
Commanders for Corvettes	50	40
Lieutenants	230	220
Sub-Lieutenants	142	142
Midshipmen	71	64
Engineers, Constructors	73	73
Naval Engineers.	98	94
Medical Officers	135	125
Commissariat Staff	315	314
Engine-room Staff	2,020	1,708
Torpedo Staff	752	612
Gunnery Ratings	1,553	1,553
A. B.'s and Ordinary Seamen	4,135	4,643
Armourers and other Artificers	483	388
All other ranks	2,057	1,946
	12,205	11,963

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Italian Navy Estimates—continued.

AMOUNTS voted in ITALIAN NAVY ESTIMATES, from 1873 to 1886, exclusive of EXPENSES connected with the ADMIRALTY OFFICE, the MERCANTILE MARINE, and IMPREST ACCOUNTS.

Year.	Ordinary Estimate.	Extraordinary Estimate.	Total.
	£	£	£
1873	1,211,780	42,800	1,254,580
1874	1,264,888	39,800	1,304,688
1875	1,266,992	207,240	1,474,232
1876	1,415,084	51,996	1,467,080
1877	1,604,676	41,760	1,646,436
1878	1,562,476	109,000	1,671,476
1879	1,525,220	105,160	1,630,380
1880	1,606,936	128,000	1,734,936
1881	1,594,772	116,344	1,711,116
1882	1,762,162	112,320	1,874,482
1883	2,212,620	220,000	2,432,620
1884 1 Jan. to 30 June	989,644	118,520	1,108,164
1884-85	1,830,072	252,400	2,082,472
1885-86	2,218,756	686,400	2,905,156
1886-87	2,475,070	480,640	2,955,710
	24,541,148	2,712,380	27,253,790

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Italian Navy Estimates—continued.

SHIPS in COMMISSION, 1886.

Name.	Description.	Station.	Period.
Italia	Ironclad	Home	3 Months.
Dandolo	„	„	3 „
Duilio	„	„	3 „
Affondatore	„	„	9 „
Giovanni Bausan	„	„	9 „
Principe Amadeo	„	„	12 „
Castelfidardo	„	„	3 „
Maria Pia	„	„	12 „
Ancona	„	„	12 „
Colonna	Despatch Vessel	„	6 „
Folgore	„ „	„	6 „
Tripoli	„ „	„	6 „
Vedetta	„ „	„	3 „
Volta	Transport	„	6 „
Verdi and Pagano	Tank Vessels	„	6 „
	12 Torpedo Boats	„	6 „
	5 Steam Vessels	„	..
	2 Tank Vessels	„	..
Vespucci	Deck-protected Cruiser	South America	12 Months.
Flavio Gioia	„ „	„ „	12 „
S. Veniero	Gunboat	„ „	12 „
C. Colombo	Cruiser	China	12 „
San Martino	Ironclad	Levant	12 „
A. Provana	Gunboat	.. ..	12 „
Sicilia	.. ..	Red Sea	12 „
Cariddi	.. ..	„	12 „
Mestre	Steamer	„	12 „
Chioggia	.. ..	„	12 „
Eridano	Distilling Ship	„	12 „
Tevere	Tank Vessel	„	12 „
	Ice Ship	„	12 „
Washington	Hydrographic Service	„	8 „

NAVAL SCHOOLS.

Vittorio Emanuele	Frigate	.. ..	4 Months.
V. Pisani	Corvette	.. ..	12 „
Maria Adelaide	Frigate	.. ..	12 „
Venezia	Corvette	.. ..	12 „
Caracciolo	„	.. ..	8 „
Sesia	Steam Vessel	.. ..	12 „

SPECIAL SERVICE.

Staffetta	Despatch Vessel	.. ..	6 Months.
Rapido	„ „	.. ..	6 „
Vedetta	„ „	.. ..	6 „
Savoia	Cruiser	.. ..	3 „
Messagiero	Despatch Vessel	.. ..	3 „

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Russian Navy Estimates.

Head of Service.	1886.	1885.
	£	£
Central and Harbour Administration	170,880	125,040
Rewards and Gratuities	48,920	54,120
Schools	51,510	52,620
Medical Service	82,130	88,330
Pay of Officers and Men	377,590	381,010
Provisions	86,760	95,280
Clothing	89,870	91,500
Cruising in Home Waters	283,580	270,700
Do. Foreign Waters	207,980	276,370
Hydrographical Branch	41,920	41,510
Naval Artillery and Torpedo Service	310,520	212,660
Shipbuilding	1,568,590	1,260,070
Workshops and Offices	139,600	138,070
Buildings—Hire, Maintenance, Construction, and Repairs	303,570	285,900
Travelling Expenses of Officers abroad	40,000	40,000
Miscellaneous	137,170	136,930
(*Revue Maritime et Coloniale*)	3,940,590	3,550,110

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An extraordinary activity prevails in the Russian Admiralty, which shows itself in the construction, not only of armoured vessels, but also of modern cruisers. This is explained by the attitude of England.

The resources of the Royal Dockyards and private establishments of the country are insufficient, and many vessels have therefore been ordered abroad.

THE FOLLOWING SHIPS ARE NOW IN COURSE OF CONSTRUCTION.

(From Return No. 153, presented to House of Commons 17 May, 1886.)

Name of Vessel.	Class.	Tons Displacement.	Speed.
ARMOURED SHIPS.			Knots.
Emperor Alexander II. . .	Armoured Vessel. . .	8,440	15
Ekaterina II. . . .	„ „ . . .	10,800	15
Tchesma	„ „ . . .	10,800	15
Sinope	„ „ . . .	10,800	15
Admiral Nachhimoff . .	Belted Cruiser . . .	7,780	16
Alexander Nevsky . .	„ „ . . .	7,572	16
Emperor Nikolas . .	„ „ . . .	8,000	16
UNARMOURED SHIPS.			
Rynda	Deck-protected Corvette .	2,950	15
N.	„ „ .	5,029	18
Ilyin	Torpedo Vessel . . .	600	20
Captain Saken . . .	„ „ . . .	600	20
6 Gunboats			
13 Torpedo Boats, over 100 ft. in length			

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Another unarmoured vessel has been ordered from the firm of Burmeister and Wain, of Copenhagen, to strengthen the fleet on the Pacific Station. The specifications for this vessel have been worked out by the Russian Admiralty. Its armament will consist of two 8-in. and one 6-in. guns. According to the terms of contract, one year only is to be allowed for completion, in order that the vessel may be ready for completion in the spring of 1887.

Four new torpedo boats, constructed by Schichau of Elbing, have lately been delivered to the Russian Government.

These boats are stated to be remarkable for their speed and the saving of fuel effected. The first boat, during six hours' steaming, averaged 22·24 knots an hour. The result of the speed-trials of the second and third boats have not been published. The performance of the fourth boat is stated to have been remarkable. This boat had on board a crew of eighteen men, coals for a run of 1200 miles, and 145 tons of ballast, and yet she is reported to have attained during a three hours' run an average speed of 21·6 knots, the maximum speed reached being 23 knots. The Russian Naval Department has also been active in other ways.

The construction of the quay-walls of Cronstadt harbour has been continued, and at Sebastopol docks have been built. The Obuchoff and Isherski armour-plate manufactories have been enlarged, and improved machinery has been introduced. It has been decided to convert Windau, in the Baltic, into a war harbour, and to construct the railway which is to connect that port with Riga.

It is reported that the engineers Artseordoff, Mordirnoff, and Goulaieff are engaged on the drawings of another large ironclad of the first class to be laid down in the Sebastopol Dockyard, on the stocks vacated by the Tchesma. In some respects this ship is to be of the type of the Hero.

We are indebted to the *Times'* correspondent at Sebastopol for the following programme of Russian shipbuilding:—

The Council of the Empire in 1881, upon an examination of the Navy Estimates, ordered the Ministry of Marine to present a plan of construction founded on certain recommendations. The Admiralty thereupon proposed the subjoined project, which was accepted with

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some slight alterations. Russia requires, says the project, in addition to its present Navy:—

	Approximate Tonnage.
For the Baltic.	
11 First-class ironclads	10,000
4 Second-class ironclads	7,000
11 Gunboats	—
10 Cruisers, about the dimensions of the Iris.	—
6 Transports	2,000
For the Black Sea.	
8 First-class ironclads	10,000
6 Despatch boats	—
8 Torpedo boats	—
For the Caspian.	
3 Sea-going paddle steamers	1,000
2 Tug boats	—
9 Steam launches	—
For the Pacific.	
4 Gunboats	—
4 Torpedo boats	—
For the White Sea.	
3 Small schooners	—
4 Steam launches	—

The types and dimensions of these vessels were to be decided upon subsequently. In regard to means for carrying out this scheme, the Ministry thought there would be required—for shipbuilding, 185,623,500 roubles; for artillery, 22,857,000 roubles; and for torpedoes, 6,709,000 roubles—in all, 216,000,000 roubles; 102,000,000 roubles could be taken from the annual Estimates, and 114,000,000 would have to be added by the Ministry of Finance. It was decided that the hulls of all the ironclads and cruisers should be built in Russia of Russian material, but that no impediment should be placed in the way of buying such foreign materials as could not be easily and reasonably obtained in the country. After taking the principal materials from abroad, there would still be sufficient work to occupy the factories and mills of Kolpino, Obukhoff, Briansk, Nevsky, &c., and it was recommended that new dockyards and factories should be encouraged. These are the main features of the twenty years' project of Russian naval construction which is now being proceeded with in great haste at all the principal dockyards of the north and south.

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United States Navy Estimates, 1886-87.

COMPARISON between NAVY ESTIMATES 1886-87 and 1885-86.
(1st April to 30th June.)

Head of Service.	Voted 1886-87.	Voted 1885-86.
	£	£
Maintenance of Yards and Docks	50,400	40,000
Naval Asylum at Philadelphia	12,600	11,973
Equipment of Vessels, Coal, Hemp, and other Stores	159,800	160,000
Recruiting Expenses	9,000	6,000
Construction and Repair of Vessels	207,760	268,400
Steam Machinery, Boilers, &c.	158,220	190,000
Victuals and Clothing	227,400	217,000
Hydrographic Department (Material, Surveys, Observation of Transit of Venus, completion of Compass-testing House, Printing, &c.)	22,700	21,100
New Works and Improvements	..	66,200
Naval Ordnance	50,220	32,200
Torpedo Service	10,000	12,000
Hospital and Medical Expenses	24,000	20,000
Naval Academy	47,860	36,246
Marine Corps	169,820	173,865
Pay of the Navy (Officers and Men)	1,400,000	1,388,156
Miscellaneous Payments	48,100	75,000
Total Ordinary Estimates £	2,597,880	2,718,140
Extraordinary Estimate for Increasing Strength of Navy.	700,000	—
Total Estimates—Ordinary and Extraordinary £	3,297,880	2,718,140

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United States Navy Estimates—continued.

A Bill was presented 10th March, 1886, for making the following additions to the Naval strength of the United States.

	Displacement.	Speed.	Total Cost.
	Tons	Knots.	£
2 Seagoing Double-bottomed Armoured Vessels . .	6,000	16	1,000,000
3 Protected Double-bottomed Cruisers . . .	5,000	..	800,000
4 First-class Torpedo Boats	..	..	80,000
1 Torpedo Cruiser	..	..	60,000
10 New Vessels.			
For Completion of the 4 Double Turreted Monitors—Puritan, Amphitrite, Monadoch, and Terror . .	..	..	635,600
Naval Ordnance of Domestic Manufacture . . .	..	..	200,000
Torpedoes	..	..	25,000
Improvement of Yard Plant	..	..	50,000
£	..	..	2,850,600

This Bill was considerably modified by the Senate, and the following sums were finally allowed as extraordinary expenditure.

	£
2 Sea-going Armoured Vessels	1,000,000
1 Swift Cruiser	300,000
1 First-class Torpedo Boat	10,000
1 Dynamite-gun Cruiser	70,000
Completion of 4 Monitors.	635,600
Naval Ordnance, including Torpedoes	200,000
	£2,215,600

The expenditure to be spread over three years, and £700,000 to be available for 1886–87.

The armour used in constructing above vessels to be of best obtainable quality and of domestic manufacture, provided contract for furnishing the same in a reasonable time, at a reasonable price, and of required quality can be made with responsible parties; otherwise the Secretary of the Navy is authorised to purchase the same, or any portion thereof, and import it.

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One or more of the new vessels to be constructed, and one or more of the monitors to be completed in navy yards of United States.

Engines, boilers, and machinery to be if practicable of domestic manufacture.

Extracts from Report of Committee on Naval Affairs, recommending passage of Bill quoted above for increasing Naval Establishment.

"Our Navy is not equal to what it was in 1860.

"But all other maritime nations, profiting by the lessons taught during our civil war, have vied with each other in improving their navies.

"Iron took the place of wood for vessels, and steel has now taken the place of iron for both vessels and guns. Ships and guns have grown larger and heavier, and for twenty years the contest has gone on, between the power of armour to resist, and the power of guns to pierce. It now seems to be almost definitely settled that a modern projectile, thrown from the heaviest and best gun, will pierce at point blank range the heaviest armour a seagoing vessel can carry. Yet though this is generally conceded, the guns which possessed this power are so heavy, so expensive, and necessarily so few in one vessel, and the conditions of a combat at sea are so different from target practice, that the great naval Powers of the world are continuing and probably will continue to build armour-clad vessels.

"Lieut. Jaques of the United States Navy, in a pamphlet on this subject published during the present year, says:—

> 'To those who consider armour useless, because the penetrating power of modern artillery is superior to the resistance of modern plates, I would call attention to the fact, that the circumstances attending target practice on the proving grounds—the fire normal, guns on fixed platform, and the range only a few hundred feet—are very different from those in battle, where the range is great, the armour fitted to the fort or ship, is constructed to present the least amount of normal surface, and the attacking gun and moving ship, are ever changing their positions. According to Noble, one of the ablest artillerists, a thickness of armour equal to one half of the diameter of the projectile, will insure almost impenetrability in the ever varying conditions of a battle at sea.'

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United States Navy—continued.

"But as at present circumstanced, it is of small moment to the United States whether the modern gun or modern armour is superior. We have neither the one nor the other—no gun mounted that can pierce an enemy's armour—no armour on a completed vessel, or on a fort that can resist an enemy's guns.

"All nations, except America, are supplying themselves with the Whitehead Torpedo; but our Government has absolutely no movable torpedoes that can be considered as having passed beyond the stage of experiment."

Personnel.

Provision is made for the following numbers of Officers and Men:

1	Admiral.
1	Vice-Admiral.
1	Rear-Admiral.
18	Commodores.
43	Captains.
85	Commanders.
74	Lieut.-Commanders.
348	Lieutenants.
191	Ensigns.
296	Cadets.
160	Surgeons.
122	Paymasters.
240	Engineers.
265	Petty Officers.
7,500	Seamen.
750	Boys.
69	Various ranks.
10,164	

N.B.—The above statement as to the Personnel is extracted from the *Carnet de l'Officier de Marine*, for 1886.

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MERCHANT NAVIES OF PRINCIPAL MARITIME POWERS.

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TONNAGE of the MERCHANT NAVIES of the PRINCIPAL MARITIME
Years, 1820, 1830, 1840, 1850,

COUNTRIES.	1820.	1830.	1840.	1850.
	Tons.	*Tons.*	*Tons.*	*Tons.*
British Empire* (including United Kingdom) .	2,648,593	2,531,819	3,311,538	4,232,962
United Kingdom	.. ..	.. ..	2,724,107	3,504,944
Norway †	.. ..	169,197	276,697	298,315
Sweden	.. ..	.. ..	.. ..	.. ..
Denmark	.. ..	.. ..	.. ..	.. ..
Hamburg	.. ..	.. ..	.. ..	71,257
Bremen	17,283	20,206	43,647	67,770
Total German Empire	.. ..	.. ..	.. ..	.. ..
Holland	.. ..	.. ..	.. ..	292,576
Belgium	.. ..	.. ..	22,610	34,919
France	.. ..	.. ..	662,500	688,153
Italy ‡	.. ..	.. ..	.. ..	.. ..
Austro-Hungarian Empire §	.. ..	.. ..	.. ..	.. ..
Greece	.. ..	.. ..	.. ..	.. ..
United States: ‖				
Registered for Oversea (Foreign Trade) .	.. ..	576,475	899,765	1,585,711
¶ Enrolled and Licensed (including Lake and River Steamers).	.. ..	591,447	1,240,860	1,899,555

* In consequence of steps taken to clear the British Register in and since 1854, and in consequence of alterations in the system of measurement, the British tonnage, as compared with previous years, is a great deal less than it would have appeared to be if the old plan of taking the figures had continued.

† Up to the year 1865 eight tons was the lowest limit for vessels in this category; after that year the limit was extended, and now includes all vessels down to those of three tons.

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COUNTRIES of EUROPE, and of the UNITED STATES, in each of the 1860, 1870, and 1875–84.

1860.	1870.	1875.	1876.	1877.	1878.	1879.	1880.
Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
5,710,968	7,149,134	7,744,237	7,964,578	8,133,837	8,329,421	8,462,364	8,447,171
4,586,742	5,617,693	6,087,701	6,197,968	6,336,360	6,492,121	6,521,289	6,519,772
558,927	1,022,515	1,419,308	1,436,278	1,493,041	1,526,689	1,510,669	1,511,658
.. ..	346,862	507,049	524,982	529,945	536,610	530,803	542,642
.. ..	178,646	244,100	254,313	252,062	251,209	251,958	249,466
142,416	184,496	219,567	219,698	223,910	219,861	245,709	244,279
121,863	171,654	182,073	196,000	216,032	234,718	260,769	270,209
.. ..	982,355	1,084,882	1,103,650	1,117,935	1,129,129	1,171,286	1,182,097
433,922	389,614	410,689	419,775	365,256	358,995	347,665	328,281
33,111	30,149	50,186	44,980	48,405	60,708	71,191	75,666
996,124	1,072,048	1,021,228	1,011,285	989,128	975,883	932,853	919,298
.. ..	1,012,164	1,044,337	1,078,369	1,068,449	1,029,157	1,005,972	999,196
.. ..	329,377	290,450	290,002	283,189	286,078	282,571	290,971
263,075	404,063	262,032	—	—	—	—	—
2,546,237	1,516,800	1,553,827	1,592,821	1,611,193	1,629,047	1,491,533	1,352,810
2,752,938	2,677,940	3,299,905	2,686,637	2,631,407	2,583,718	2,678,068	2,715,224

‡ The returns for Italy are exclusive of Venetia previous to the year 1870, and of Rome previous to 1871. In 1871, and in the subsequent years, fishing vessels are excluded.

§ Including the vessels trading on the Danube. Excluding small coasting vessels and fishing boats.

‖ Years ended 30th June. The tonnage for 1870 and subsequent years is new admeasurement.

¶ Registered tonnage is that employed in the foreign trade. Enrolled and licensed is that employed in the river, lake, and home trade.

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TONNAGE of the MERCHANT NAVIES of the PRINCIPAL MARITIME COUNTRIES of EUROPE, and of the UNITED STATES, in each of the Years 1820, 1830, 1840, 1850, 1860, 1870, and 1875–84—*continued.*

COUNTRIES.	1881.	1882.	1883.	1884.
	Tons.	*Tons.*	*Tons.*	*Tons.*
British Empire * (including United Kingdom) .	8,575,560	8,796,517	9,131,418	9,314,496
United Kingdom	6,641,267	6,908,650	7,196,401	7,363,707
Norway †	1,520,404	1,530,004	1,546,793	—
Sweden	529,613	527,456	—	—
Denmark	253,409	256,858	266,396	—
Hamburg	270,055	288,236	307,338	—
Bremen	280,088	299,397	307,559	—
Total German Empire	1,194,407	1,226,650	1,269,477	—
Holland	305,046	302,790	309,764	—
Belgium	77,840	82,647	86,360	—
France	914,373	983,017	1,003,679	—
Italy ‡	989,057	990,004	973,333	—
Austro-Hungarian Empire §	286,556	288,011	280,184	—
Greece	—	—	—	—
United States : ‖				
Registered for Oversea (Foreign Trade) .	1,335,586	1,292,294	1,302,095	1,304,221
¶ Enrolled and Licensed (including Lake and River Steamers).	2,722,148	2,873,639	2,933,392	2,967,008

* In consequence of steps taken to clear the British Register in and since 1854, and in consequence of alterations in the system of measurement, the British tonnage, as compared with previous years, is a great deal less than it would have appeared to be if the old plan of taking the figures had continued.

† Up to the year 1865 eight tons was the lowest limit for vessels in this category; after that year the limit was extended, and now includes all vessels down to those of three tons.

‡ The returns for Italy are exclusive of Venetia previous to the year 1870, and of Rome previous to 1871. In 1871, and in the subsequent years, fishing vessels are excluded.

§ Including the vessels trading on the Danube. Excluding small coasting vessels and fishing boats.

‖ Years ended 30th June. The tonnage for 1870 and subsequent years is new admeasurement.

¶ Registered tonnage is that employed in the foreign trade. Enrolled and licensed is that employed in the river, lake, and home trade.

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The following Tables, giving the population of the United Kingdom engaged in occupations connected with the sea, are extracted from the Report of the Census of 1881:—

ENGLAND AND WALES.

Ship, Boat, Barge Builders	21,741
Shipwrights, Ship-carpenters (ashore)	23,930
Ship Riggers, Chandlers, Fitters	2,861
Anchor, Chain manufacturers	5,029
Mast, Yard, Oar, Block makers	1,419
Sail makers	4,129
Total engaged in making or equipping vessels	59,109
Seamen (Merchant Service) enumerated	95,093
Seamen (English and Welsh) abroad	63,330
Bargemen, Lightermen, Watermen	30,223
Boatmen on Seas	1,570
Pilots	2,991
Ship Stewards, Cooks	6,767
Total seagoing persons	199,974
Navigation Service (on shore)	4,697
Harbour, Dock, Lighthouse Service	42,643
Total of Shore Service	47,340
Total engaged in Water Traffic	306,423

Neglecting, as insignificant in number, the few professional fishermen in inland waters, the fishermen are, of course, limited by the nature of their industry to the maritime districts. Their distribution, following the coast line, was as follows:—

Northumberland	1,402	Dorsetshire	370
Durham	327	Devonshire	1,826
North Riding	1,232	Cornwall	4,400
East Riding	2,003	Somersetshire	59
Lincolnshire	4,357	Gloucestershire	105
Norfolk	2,898	South Wales	637
Suffolk	2,763	North Wales	284
Essex	980	Cheshire	334
Kent	1,793	Lancashire	1,342
Sussex	1,473	Cumberland	149
Hampshire	527		

The Census for Scotland gave 22,354 males on canals, rivers, and seas at the date of enumeration; also 16,647 employed in ship-building, and 11,823 riggers.

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TONNAGE OF STEAM VESSELS.

EUROPE AND UNITED STATES, 1840–1884.

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TONNAGE of STEAM VESSELS only, belonging to the PRINCIPAL MARITIME
1840, 1850, 1860,

COUNTRIES.	1840.	1850.	1860.	1870.	1875.	1876.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
British Empire *	95,807	187,631	500,144	1,202,134	2,072,804	2,150,302
United Kingdom	87,539	167,698	452,352	1,111,375	1,943,197	2,002,538
Norway	.. ..	.. ..	.. ..	13,715	43,875	45,941
Sweden	.. ..	.. ..	.. ..	.. ..	83,007	81,659
Denmark	.. ..	.. ..	.. ..	10,453	39,368	43,610
Hamburgh	.. ..	2,842	10,184	32,450	89,730	84,683
Bremen	.. ..	.. ..	8,483	41,393	55,319	57,685
Total German Empire	.. ..	.. ..	.. ..	81,994	183,569	180,946
Holland	.. ..	2,706	10,132	19,455	59,925	57,547
Belgium	1,048	1,604	4,254	9,501	35,430	29,850
France	9,535	13,925	68,025	154,415	205,420	218,449
Italy †	.. ..	.. ..	.. ..	32,100	57,147	57,881
Austro-Hungarian Empire.	.. ..	.. ..	.. ..	49,977	56,271	56,959
Greece	.. ..	.. ..	.. ..	5,360	8,241	—
United States; ‡						
Registered for Oversea (Foreign Trade).	4,155	44,942	97,296	192,544	191,689	198,227
Enrolled and Licensed (including Lake and River Steamers). §	198,184	481,005	770,641	882,551	976,979	974,145

* In consequence of steps taken to clear the British Register in and since 1854, and of alterations in the system of measurement, the British tonnage, since 1854, as compared with the previous years, is a great deal less than would have appeared if the old plan of taking the figures had continued.

† The returns for Italy are exclusive of the Roman States previous to 1871.

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COUNTRIES of EUROPE, and to the UNITED STATES, in each of the Years 1870, and 1875–84.

1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.
Tons. 2,292,423	*Tons.* 2,492,327	*Tons.* 2,733,269	*Tons.* 2,949,282	*Tons.* 3,239,503	*Tons.* 3,571,078	*Tons.* 4,013,677	*Tons.* 4,249,442
2,136,361	2,313,332	2,508,102	2,720,551	3,001,377	3,331,895	3,725,229	3,941,056
46,869	51,674	54,781	58,062	65,627	82,519	92,084	—
83,146	82,119	83,659	81,049	79,245	87,524	—	—
45,096	46,623	48,799	51,957	61,426	70,706	81,042	—
84,135	75,040	92,237	99,153	128,891	149,774	173,542	—
57,380	59,902	59,462	58,606	60,676	75,702	89,046	—
183,379	179,662	196,343	215,758	251,648	311,204	374,699	—
57,604	59,473	58,653	64,394	72,224	85,273	101,667	—
37,858	50,389	59,536	65,224	70,486	75,897	79,902	—
230,804	245,898	255,959	277,759	311,779	416,228	467,488	—
58,319	63,020	72,666	77,050	93,698	104,719	107,452	—
56,075	57,003	58,604	62,743	65,755	78,433	76,780	—
—	—	—	—	—	—	—	—
190,133	170,838	156,323	146,604	152,769	154,570	171,905	184,188
981,064	996,840	1,019,849	1,064,954	1,112,229	1,201,255	1,241,289	1,281,721

‡ Years ended 30th June. The tonnage for 1870 and subsequent years is all new admeasurement.
§ The "enrolled and licensed" tonnage of the United States is confined to the home and river trades, and is prohibited by law from going on a foreign voyage.

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TONNAGE of VESSELS BUILT in the UNITED KINGDOM, in each Year from 1858 to 1884.

Years.	For Home and the Colonies.	For Foreigners.	Total.
	Tons	Tons.	Tons.
1858	208,080	28,474	236,554
1859	185,970	26,774	212,744
1860	211,968	13,903	225,871
1861	200,839	7,487	208,326
1862	241,399	20,533	261,932
1863	364,724	17,320	382,044
1864	433,045	28,960†	462,005†
1865	415,204	32,965†	448,169†
1866	341,189	38,350†	379,539†
1867	269,080	36,899†	305,979†
1868	316,197	46,131†	362,328†
1869	354,287	33,805†	388,092†
1870	342,706	51,651†	394,357†
1871	354,355	36,703†	391,058†
1872	392,971	81,747†	474,718†
1873	370,666	82,877†	453,543†
1874	521,203	82,664†	603,867†
1875	420,551	51,507†	472,058†
1876	360,365	17,655†	378,020†
1877	433,650	17,269†	450,919†
1878	428,245	42,474†	470,719†
1879	356,835	49,156†	405,991†
1880	403,841	69,055†	472,896†
1881	501,184	107,694†	608,878†
1882	667,275	115,776†	783,051†
1883	768,576	123,640†	892,216†
1884	497,442	90,832†	588,274†

† Including the following, built for War purposes for Foreigners:

	Tons.
In 1864	6,497
1865	3,700
1866	10,301
1867	4,994
1868	10,254
1869	2,354
1870	970
1871	80
1872	40
1873	280
1874	12,877
1875	13,844
1876	14
1877	3,435
1878	2,482
1879	716
1880	385
1881	5,338
1882	447
1883	270
1884	2,339

Not distinguished previous to 1864.

Note.—The Returns for the years prior to 1871 denote the tonnage of the newly-built vessels which were *first registered* in those years, but in the Returns for that and the following years the tonnage of vessels, the building of which was completed in those years, is given, whether registered or not.

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TONNAGE of VESSELS BUILT in FRANCE, Bought Abroad, and Sold to Foreigners in each of the Years 1855 to 1883.

Years.	Tonnage of Vessels Built.	Tonnage of Vessels Bought Abroad.	Tonnage of Vessels Sold to Foreigners.
	Tons.	Tons.	Tonnage.
1855	103,488		1,919
1856	174,018		2,414
1857	116,910		4,318
1858	66,427		10,910
1859	37,216		9,404
1860	43,192		13,182
1861	45,100		10,354
1862	52,444		8,760
1863	59,467		9,625
1864	64,670		6,856
1865	76,817		4,907
1866	75,990		3,982
1867	81,127		4,914
1868	68,983		5,298
1869	73,878		2,811
1870	62,895		11,135
1871	58,541		16,341
1872	50,697	34,885	17,865
1873	39,430	17,646	19,848
1874	34,917	17,404	27,092
1875	37,529	20,001	14,722
1876	32,707	15,581	16,148
1877	26,884	12,864	14,751
1878	21,367	19,677	12,851
1879	24,733	16,809	8,323
1880	12,629	34,201	12,939
1881	20,735	34,909	11,441
1882	56,594	78,612	17,407
1883	35,223	49,387	14,681

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NUMBERS of BRITISH and FOREIGN SEAMEN serving in REGISTERED SAILING and STEAM VESSELS of the UNITED KINGDOM (exclusive of River Steamers), employed in the Home and Foreign Trade, showing the Proportions of Foreign to British Seamen, from 1851 to 1884.

(Masters are not included in this Return.)

Year.	Number of British Seamen Employed.	Number of Foreign Seamen Employed.	Total Number of Seamen Employed.	Per-centage of Foreign to British Seamen Employed.
1851 . . .	136,144	5,793	141,937	4·2
1852 . . .	153,863	5,700	159,563	3·7
1853 . . .	165,205	7,321	172,526	4·4
1854 . . .	149,215	13,200	162,415	8·8
1855 . . .	155,610	12,927	168,537	8·3
1856 . . .	160,597	13,321	173,918	8·3
1857 . . .	162,012	14,375	176,387	8·9
1858 . . .	165,498	12,334	177,832	7·4
1859 . . .	160,210	12,296	172,506	7·6
1860 . . .	157,312	14,280	171,592	9·0
1861 . . .	Not separated.		171,957	—
1862 . . .	157,767	16,096	173,863	10·2
1863 . . .	165,794	18,933	184,727	11·4
1864 . . .	173,833	21,923	195,756	12·6
1865 . . .	177,363	20,280	197,643	11·4
1866 . . .	Not separated.		196,371	—
1867 . . .	174,523	21,817	196,340	12·5
1868 . . .	177,239	20,263	197,502	11·4
1869 . . .	175,332	20,158	195,490	11·4
1870 . . .	177,951	18,011	195,962	10·1
1871 . . .	181,973	17,765	199,738	9·76
1872 . . .	183,129	20,591	203,720	11·24
1873 . . .	182,399	19,840	202,239	10·87
1874 . . .	182,687	20,919	203,606	11·45
1875 . . .	178,994	20,673	199,667	11·55
1876 . . .	177,727	20,911	198,638	11·76
1877 . . .	173,926	22,636	196,562	13·01
1878 . . .	172,242	23,343	195,585	13·55
1879 . . .	169,145	24,403	193,548	14·43
1880 . . .	169,692	23,280	192,972	13·72
1881 . . .	168,098	24,805	192,903	14·76
1882 . . .	169,920	26,017	195,937	15·31
1883 . . .	172,414	28,313	200,727	16·42
1884 . . .	171,871	27,783	199,654	16·17

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STATISTICS RELATING TO THE POPULATION AND TRADE OF THE UNITED KINGDOM, INDIA, AND THE COLONIES.

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Area and Population of Colonial and other Possessions.

Possessions.	Area.	Population. 1871.			1881.			1884.		
	Square Miles.	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
India (British) *a*	868,314	..	..	191,018,412	101,292,504	97,498,349	198,790,853	—	—	—
Straits Settlements	1,472	200,433	107,664	308,097	281,687	141,697	423,384	370,000	170,000	540,000
Ceylon	25,365	1,285,885	1,120,377	2,406,262	1,473,515	1,290,469	2,763,984	—	—	—
Mauritius	713	201,164	128,590	329,754*b*	218,121	159,252	377,373*b*	212,393	158,373	370,766*b*
Labuan	30	3,027	1,871	4,898	3,927	2,371	6,298	—	—	—
Hong Kong	30·5	90,435	33,763	124,198	115,369	45,033	160,402	—	—	—
Australasia :—										
New South Wales	311,098	275,551	228,430	503,981	411,149	340,319	751,468	511,257	410,011	921,268
Victoria	87,884	401,050	330,478	731,528	452,083	410,263	862,346	510,659	450,617	961,276
South Australia	903,690	95,408	90,218	185,626	149,530	130,335	279,865 *c*	164,877	147,904	312,781
Western Australia	1,060,000	15,565	9,788	25,353	17,062	12,646	29,708	18,005	13,695	31,700
Tasmania	26,215	53,911	47,874	101,785	61,162	54,543	115,705	69,140	61,401	130,541
New Zealand	104,458	150,356	106,037	256,393*d*	269,605	220,328	489,933*d*	306,667	257,637	564,304*d*
Queensland	668,497	71,767	48,337	120,104	125,325	88,200	213,525	182,442	127,471	309,913
Total	3,161,842	1,063,608	861,162	1,924,770	1,485,916	1,256,634	2,742,550	1,763,047	1,468,736	3,231,783
Fiji *e*	7,740	..	..	..	70,248	56,847	127,095	70,856	57,758	128,614
Falkland Isles	6,500	534	229	811*f*	976	577	1,553	—	—	—
Natal	18,750	146,756	143,017	289,773	191,376	203,814	402,687*g*	204,907	219,588	424,495
Cape of Good Hope *h*	219,700	255,760	240,621	582,582*i*	369,628	351,356	720,984*k*	..	..	1,249,824 *l*
St. Helena	47	2,999	3,242	6,241	2,573	2,486	5,059	—	—	—
Lagos	1,069	28,963	33,058	62,021	37,665	37,605	75,270	—	—	—
Gold Coast	18,784	..	..	408,070	Not ascertained			..	..	651,000*m*
Sierra Leone	468	..	..	..	31,201	29,345	60,546	—	—	—
Gambia	69	7,306	6,884	14,190	7,215	6,935	14,150	—	—	—
North America :—										
Dominion of Canada :										
Ontario and Quebec	290,421	1,424,631	1,387,736	2,812,367	1,654,645	1,627,610	3,282,255	..	..	3,437,819
New Brunswick	27,174	145,888	139,706	285,594	164,119	157,114	321,233	..	..	332,767
Nova Scotia	20,907	193,792	194,008	387,800	220,538	220,034	440,572	..	..	457,762
Manitoba	123,200	..	..	12,228	37,207	28,747	65,954	—	—	—
Prince Edward Island	2,133	47,121	46,900	94,021	54,729	54,162	108,891	..	..	113,792
British Columbia, Vancouver's Island	341,305	..	..	33,586	29,503	19,956	49,459	—	—	—
North-West Territory, &c.	2,665,252	..	..	60,500	28,113	28,333	56,446	—	—	—
Newfoundland	40,200	..	..	146,536*n*	..	..	179,509	..	..	197,332
Total of North America	3,510,592	..	..	3,832,632	..	..	4,504,319	—	—	—

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Bermuda	19	5,402	6,719	12,121	6,448	7,500	13,948	7,267	7,621	14,888
Honduras	6,400	12,603	12,107	24,710	14,108	18,844	27,452	—	—	—
West India Islands:—										
Bahamas	5,390	19,349	19,813	39,162	20,734	22,787	43,521	—	—	—
Turk's Island	169	2,274	2,449	4,723	2,232	2,500	4,732	—	—	—
Jamaica	4,193	246,573	259,581	506,154	282,957	297,847	580,804	—	—	—
Windward Islands:—										
St. Lucia	238	15,532	16,078	31,610	18,973	19,578	38,551	19,991	20,690	40,681
St. Vincent	133	16,865	18,823	35,688	19,047	21,501	40,548	20,096	22,943	43,039
Barbadoes	166	73,452	88,590	162,042	77,253	94,607	171,860	—	—	—
Grenada	133	..	..	37,684	20,074	22,329	42,403	21,628	23,867	45,495
Tobago	114	8,262	8,792	17,054	8,694	9,357	18,051	9,216	9,859	19,075
Leeward Islands:—										
Virgin Islands	57	3,379	3,272	6,651	2,537	2,750	5,287	—	—	—
St. Christopher	65	13,259	14,910	28,169	13,706	15,431	29,137	19,142	21,859	41,001
Nevis	50	5,451	6,252	11,703	5,436	6,428	11,864			
Antigua	170	15,998	19,159	35,157	16,147	18,817	34,964	—	—	—
Montserrat	32	3,978	4,715	8,693	4,639	5,444	10,083	5,039	5,779	10,818
Dominica	291	12,737	14,441	27,178	12,867	15,344	28,211	13,147	15,693	28,840
Trinidad	1,754	60,405	49,233	109,638	83,716	69,412	153,128	..	..	166,628
Total of West India Islands	..	..	..	1,061,306	589,012	624,132	1,213,144	—	—	—
British Guiana	109,000	108,792	84,699	193,491*p*	140,134	112,052	252,186*p*	145,979	118,082	264,061
Gibraltar	1⅞	8,969	9,726	18,695*b*	8,640	9,741	18,381*b*	—	—	—
Malta	119	70,035	71,883	141,918*b*	73,430	76,352	149,782*b*	77,084	79,591	156,675*b*

a. Exclusive of the Feudatory Native States, 509,730 square miles in area, with a population of 55,191,742 persons according to the Census of 1881. *b.* Exclusive of the Military population. *c.* Exclusive of Aborigines. *d.* Exclusive of Maoris, estimated at 37,502 in 1871 and 44,097 in 1881. *e.* Area of inhabited islands, exclusive of Rotumah. The population figures include Rotumah. *f.* Including 48, sex not distinguished. *g.* Including 3130 coolies and 4367 natives, sex not distinguished. *h.* Inclusive of the territories annexed to Cape Colony proper. *i.* Census of 1865, including British Caffraria, population 86,201, sex not distinguished; but exclusive of the territories. *k.* Census of 1875, including British Caffraria, 3,006 square miles, population 122,154: but exclusive of Basutoland, Transkei, and Griqualand West, area 40,158 square miles, population 327,984. *l.* Approximate total population of the Colony and Dependencies, 1881. *m.* Estimate, Protectorate included. *n.* Census of 1869. *p.* Exclusive of 7000 Aborigines in 1871, but inclusive of 7656 Aborigines in 1881, sex not distinguished.

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TRADE of UNITED KINGDOM, 1885–84–83.—DISTRIBUTION of EXPORTS* from UNITED KINGDOM, according to their DECLARED REAL VALUE; and the DECLARED REAL VALUE (EX-DUTY) of IMPORTS at PORT of ENTRY, and therefore including FREIGHT and IMPORTER'S PROFIT.

Merchandise (excluding Gold and Silver) Imported from and Exported to the following Foreign Countries, &c.	1885.		1884.		1883.	
	Imports from	Exports to	Imports from	Exports to	Imports from	Exports to
I.—FOREIGN COUNTRIES.	£	£	£	£	£	£
Northern Europe; viz., Russia, Sweden, Norway, Denmark and Iceland, and Heligoland.	33,466,000	9,614,000	32,113,000	11,075,000	39,058,000	11,171,000
Central Europe; viz., Germany, Holland, and Belgium.	63,149,000	33,093,000	64,627,000	37,409,000	69,134,000	36,626,000
Western Europe; viz., France, Portugal (with Azores, Madeira, &c.), and Spain (with Gibraltar and Canaries).	48,115,000	20,858,000	50,910,000	23,725,000	54,039,000	24,380,000
Southern Europe; viz., Italy, Austrian Empire, Greece, Roumania, and Malta.	10,239,000	10,185,000	10,543,000	11,138,000	11,798,000	11,813,000
Levant; viz., Turkey, Asiatic and European (including Cyprus), and Egypt.	13,355,000	9,616,000	15,009,000	9,285,000	15,352,000	10,062,000
Northern Africa; viz., Tripoli, Tunis, Algeria and Morocco.	1,901,000	869,000	1,506,000	770,000	1,729,000	781,000
Western Africa	1,247,000	1,292,000	1,480,000	2,009,000	1,739,000	1,636,000
Eastern Africa; with African Ports on Red Sea, Aden, Arabia, Persia, Bourbon, and Kooria Mooria Islands.	451,000	811,000	466,000	590,000	999,000	845,000
Indian Seas, Siam, Sumatra, Java, Philippines; other Islands.	4,262,000	2,855,000	4,758,000	3,379,000	5,876,000	3,599,000
South Sea Islands	84,000	88,000	130,000	91,000	121,000	141,000
China and Japan, including Hong Kong . .	10,047,000	11,023,000	11,882,000	9,628,000	12,058,000	9,395,000
United States of America	86,158,000	21,977,000	86,054,000	2.,430,000	98,521,000	27,383,000
Mexico and Central America	1,795,000	1,466,000	2,000,000	1,916,000	1,869,000	2,391,000
Foreign West Indies, Hayti, &c.	1,216,000	2,245,000	1,323,000	2,457,000	1,509,000	3,191,000

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South America (Northern), New Granada, Venezuela, and Ecuador.	619,000	1,126,000	911,000	2,141,000	1,379,000	2,005,000
„ (Pacific), Peru, Bolivia, Chili, and Patagonia.	4,559,000	2,177,000	4,917,000	3,225,000	5,985,000	2,881,000
„ (Atlantic), Brazil, Uruguay, and Argentine Republic.	6,588,000	11,412,000	6,519,000	13,865,000	7,741,000	12,844,000
Whale Fisheries; Greenland, Davis' Straits, Southern Whale Fishery, Falkland Islands, and French Possessions in North America.	144,000	26,000	228,000	27,000	192,000	34,000
Total—Foreign Countries . . .	287,395,000	140,733,000	295,376,000	157,160,000	329,099,000	161,178,000
II.—British Possessions.						
British India, Ceylon, and Singapore . . .	38,755,000	32,182,000	41,566,000	33,964,000	45,835,000	35,218,000
Australian Colonies.—New South Wales, Victoria and Queensland.	16,018,000	18,245,000	18,409,000	17,127,000	16,925,000	16,914,000
Australian Colonies. — South Australia, West Australia, Tasmania, New Zealand, and Fiji Islands.	10,098,000	6,903,000	9,970,000	6,748,000	9,026,000	7,267,000
British North America	10,329,000	7,207,000	11,125,000	8,648,000	12,215,000	9,154,000
British West Indies with British Guiana and Honduras.	4,185,000	2,497,000	5,213,000	3,236,000	5,137,000	3,568,000
Cape and Natal.	5,134,000	3,826,000	5,950,000	4,104,000	5,868,000	4,558,000
British West Coast of Africa, Ascension and St. Helena.	880,000	663,000	1,087,000	938,000	729,000	874,000
Mauritius	310,000	263,000	357,000	389,000	415,000	506,000
Channel Islands	800,000	512,000	851,000	613,000	746,000	563,000
Total—British Possessions . . .	86,509,000	72,298,000	94,528,000	75,767,000	96,946,000	78,652,000
General Total . . .	373,904,000	213,031,000	389,904,000	232,927,000	426,045,000	239,830,000

* *i.e.*, British and Irish produce and manufactures.

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TRADE OF UNITED KINGDOM for the YEARS 1884–80.—DECLARED VALUE of the TOTAL EXPORTS of FOREIGN and COLONIAL PRODUCE and MANUFACTURES to each FOREIGN COUNTRY and BRITISH POSSESSION.

Merchandise Exported to the following Foreign Countries, &c.	1884.	1883.	1882.	1881.	1880.
I.—FOREIGN COUNTRIES.	£	£	£	£	£
Northern Europe; viz., Russia, Sweden, Norway, Denmark, and Iceland, and Heligoland.	4,451,000	4,473,000	4,674,000	5,218,000	5,416,000
Central Europe; viz. Germany, Holland and Belgium.	26,332,000	25,787,000	25,916,000	24,702,000	25,732,000
Western Europe; viz., France, Portugal, (with Azores, Madeira, &c.), and Spain, (with Gibraltar and Canaries)	11,027,000	13,480,000	14,070,000	15,102,000	13,895,000
Southern Europe; viz., Italy, Austrian Empire, Greece, Ionian Islands, and Malta.	1,829,000	1,975,000	1,738,000	1,426,000	1,418,000
Levant; viz., Turkey, Roumania,* Syria and Palestine, and Egypt.	950,000	914,000	773,000	786,000	675,000
Northern Africa; viz., Tripoli, Tunis, Algeria, and Morocco.	92,000	64,000	142,000	56,000	62,000
Western Africa	219,000	262,000	218,000	186,000	219,000
Eastern Africa; with African Ports on Red Sea, Aden, Arabia, Persia, Bourbon, and Kooria Mooria Islands.	—	—	—	—	—
Indian Seas, Siam, Sumatra, Java, Philippines; other Islands.	72,000	61,000	61,000	..	851,000
South Sea Islands	—	—	—	—	—
China, including **Hong Kong** and Japan	970,000	784,000	678,000	782,000	1,163,000
United States of America . . .	8,312,000	9,360,000	7,738,000	6,987,000	7,098,000
Mexico and Central America . .	96,000	89,000	124,000	104,000	80,000
Foreign West Indies and Hayti . .	792,000	839,000	841,000	15,000	15,000
South America (Northern), New Granada, Venezuela and Ecuador.	75,000	72,000	90,000	63,000	58,000
„ **(Pacific)**, Peru, Bolivia, Chili and Patagonia.	289,000	282,000	336,000	302,000	313,000
„ **(Atlantic)**, Brazil, Uruguay, and Argentine Confed.	489,000	555,000	578,000	355,000	358,000
Other countries (unenumerated) . .	124,000	121,000	104,000	121,000	159,000
Total—Foreign Countries . .	56,119,000	59,118,000	58,081,000	56,205,000	57,512,000
II.—BRITISH POSSESSIONS.					
British India, Ceylon, and Singapore .	1,706,000	1,712,000	1,722,000	2,031,000	1,627,000
Australian Colonies.—New South Wales and Victoria, South Australia, West Australia, Tasmania, and New Zealand.	2,909,000	2,623,000	3,086,000	2,604,000	1,817,000
British North America . . .	1,034,000	954,000	983,000	897,000	807,000
„ W. Indies with British Guiana and Honduras	355,000	374,000	327,000	342,000	407,000
Cape and Natal	431,000	443,000	582,000	619,000	576,000
British West Coast of Africa, Ascension and St. Helena.	77,000	71,000	83,000	69,000	101,000
Mauritius	40,000	74,000	54,000	43,000	28,000
Channel Islands	189,000	202,000	209,000	204,000	232,000
Other possessions	82,000	67,000	66,000	46,000	247,000
Total—British Possessions . .	6,823,000	6,520,000	7,112,000	6,855,000	5,842,000
General Total . £	62,942,000	65,638,000	65,193,000	63,060,000	63,354,000

* Wallachia and Moldavia to 1878, and Roumania in 1879.

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